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TM9-2815-222-34 & P

TECHNICAL MANUAL

DIRECT SUPPORT AND GENERAL SUPPORT MAINTENANCE MANUAL INCLUDING REPAIR PARTS AND SPECIAL TOOL LIST

ENGINE , DIESEL , 6 CYLINDER INLINE , TURBOCHARGED , CUMMINS MODEL NTC - 400

NSN 2815-01-082-8125

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WARNING

CARBON MONOXIDE POISONING CAN BE DEADLY

Carbon monoxide is a colorless, odorless, poisonous gas, which, when breathed, deprives the body of oxygen and causes suffocation. Exposure to air contaminated with carbon monoxide produces symptoms of headache, dizziness, loss of muscular control, apparent drowsiness, or coma. Permanent brain damage or death can result from severe exposure.

Carbon monoxide occurs in the exhaust fumes of fuel-burning internal combustion engines and can become dangerous under conditions of inadequate ventilation. The following precautions must be observed to insure the safety of personnel:

1. DO NOT operate the engine of a vehicle unless it is ADEQUATELY VENTILATED.
2. DO NOT idle the engine for long periods without maintaining ADEQUATE VENTILATION in the personnel compartments.
3. DO NOT drive any vehicle with inspection plates, cover plates, or engine compartment doors removed unless it is necessary for maintenance purposes.
4. BE ALERT at all times during vehicle operation for exhaust odors, and exposure symptoms. If either are present, IMMEDIATELY VENTILATE the personnel compartments. If symptoms persist, remove affected personnel from the vehicle and treat as follows:
    1. Exposure to fresh air.
    2. Keep warm.
    3. DO NOT PERMIT EXERCISE.
    4. If necessary, administer artificial respiration.

THE BEST DEFENSE AGAINST CARBON MONOXIDE POISONING IS ADEQUATE VENTILATION.

WARNING

Particles blown by compressed air are hazardous. Make certain air stream is directed away from user and other personnel in area.

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DIRECT SUPPORT AND GENERAL SUPPORT MAINTENANCE MANUAL (INCLUDING REPAIR PARTS AND SPECIAL TOOLS LISTS)

FOR

ENGINE, DIESEL: 6 CYLINDER, INLINE, TURBOCHARGED, CUMMINS MODEL NTC-400

(NSN 2815-01-082-8125)

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CHAPTER 1

INTRODUCTION

Section I. GENERAL

1-1. Scope.

a. This technical manual is for your use in operating and maintaining the Cummins NTC-400, six-cylinder, inline diesel engines.

b. Appendix A contains a list of current references, including supply manuals, forms, technical manuals, and other available publications applicable to the NTC-400 diesel engines.

c. Appendix B contains an illustrated list of all service parts and special tools with the estimated quantities of component parts and tools authorized for direct support and general support maintenance of the NTC-400 diesel engines.

d. Appendix C contains a list of expendable supplies and materials needed to operate and maintain the NTC-400 diesel engine.

1-2. Forms and Records. Department of the Army forms and procedures used for equipment maintenance will be those prescribed in TM 38-750, The Army Maintenance Management System (TAMMS).

1-3. Equipment Improvement Report and Maintenance Digest (EIR MD) and Equipment Improvement Report and Maintenance Summary (EIR MS). The quarterly Equipment Improvement Report and Maintenance Digest, TB 43-0001-39 series, contains valuable field information on the equipment covered in this manual. The information in the TB 43-0001-39 series is compiled from some of the Equipment Improvement Reports that you prepared on the vehicles covered in this manual. Many of these articles result from comments, suggestions, and improvement recommendations that you submitted to the EIR program. The TB 43-0001-39 series contains information on equipment improvements, minor alterations, proposed Modification Work Orders (MWO's), warranties (if applicable), actions taken on some of your DA Form 2028's (Recommended Changes to Publications), and advance information on proposed changes that may affect this manual. In addition, the more maintenance significant articles, including minor alterations, field-fixes, etc., that have a more permanent and continuing need in the field are republished in the Equipment Improvement Report and Maintenance Summary (EIR MS) for TARCOM Equipment (TM 43-0143). Refer to both of these publications (TB 43-0001-39 series and TM 43-0143) periodically, especially the TB 43-0001-39 series, for the most current and authoritative information on your equipment. The information will help you in doing your job better and will help in keeping you advised of the latest changes to this manual. Also refer to DA Pam 310-4, Index of Technical Publications, and Appendix A, References, of this manual.

1-4. Destruction of Army Materiel to Prevent Enemy Use. Procedures outlined in TM 750-244-6 (Procedures for Destruction of Tank-Automotive Equipment to Prevent Enemy Use) are applicable to this equipment.

Section II. DESCRIPTION AND DATA

1-5. Description. The engine used in the M915 thru M920 vehicles is a six-cylinder, four-cycle overhead valve, liquid-cooled, turbocharged diesel engine. This engine has a compression ratio of 13.5:1 and develops 400 HP at 2100 rpm.

1-6. Component Location. Figures 1-1 and 1-2 show the location of the major engine components.

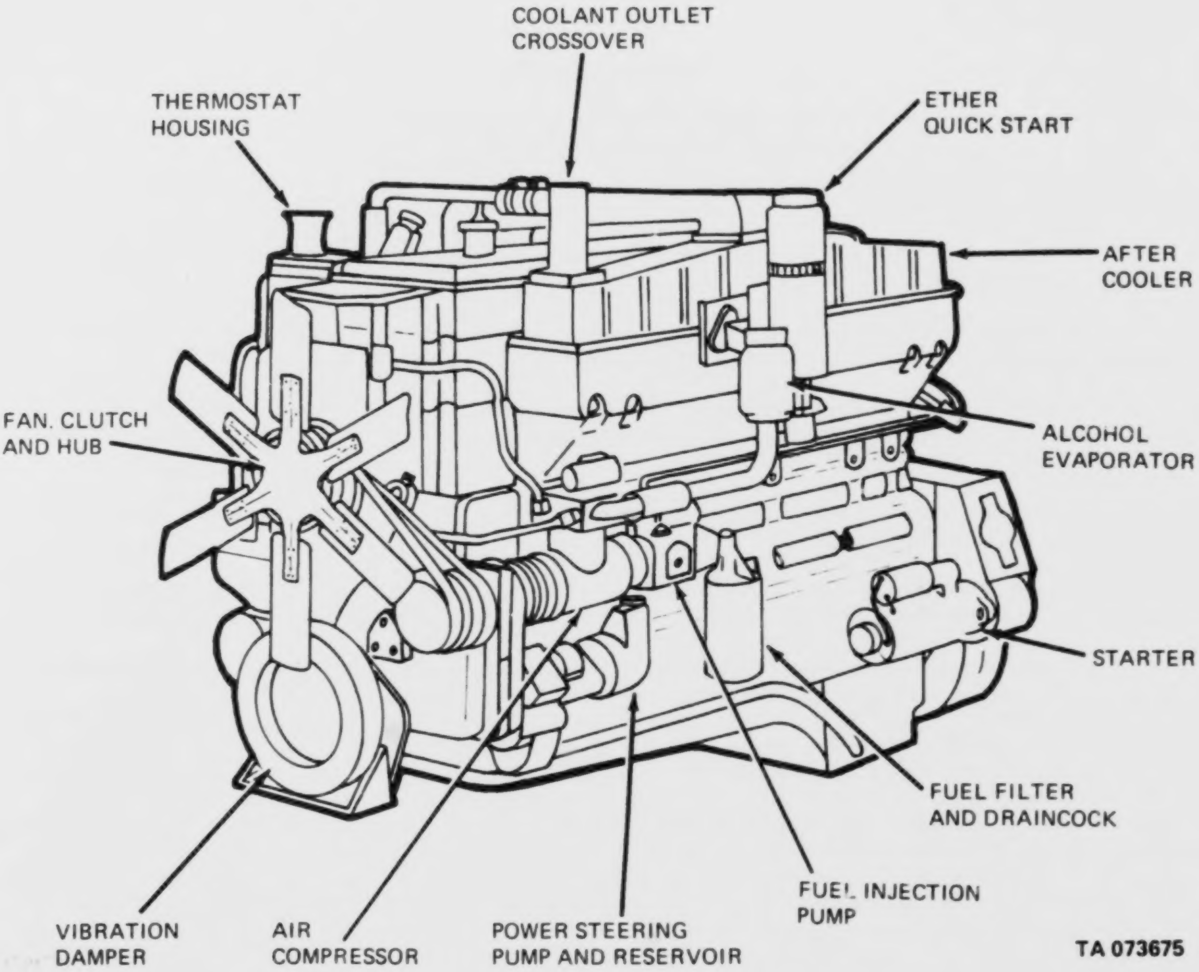
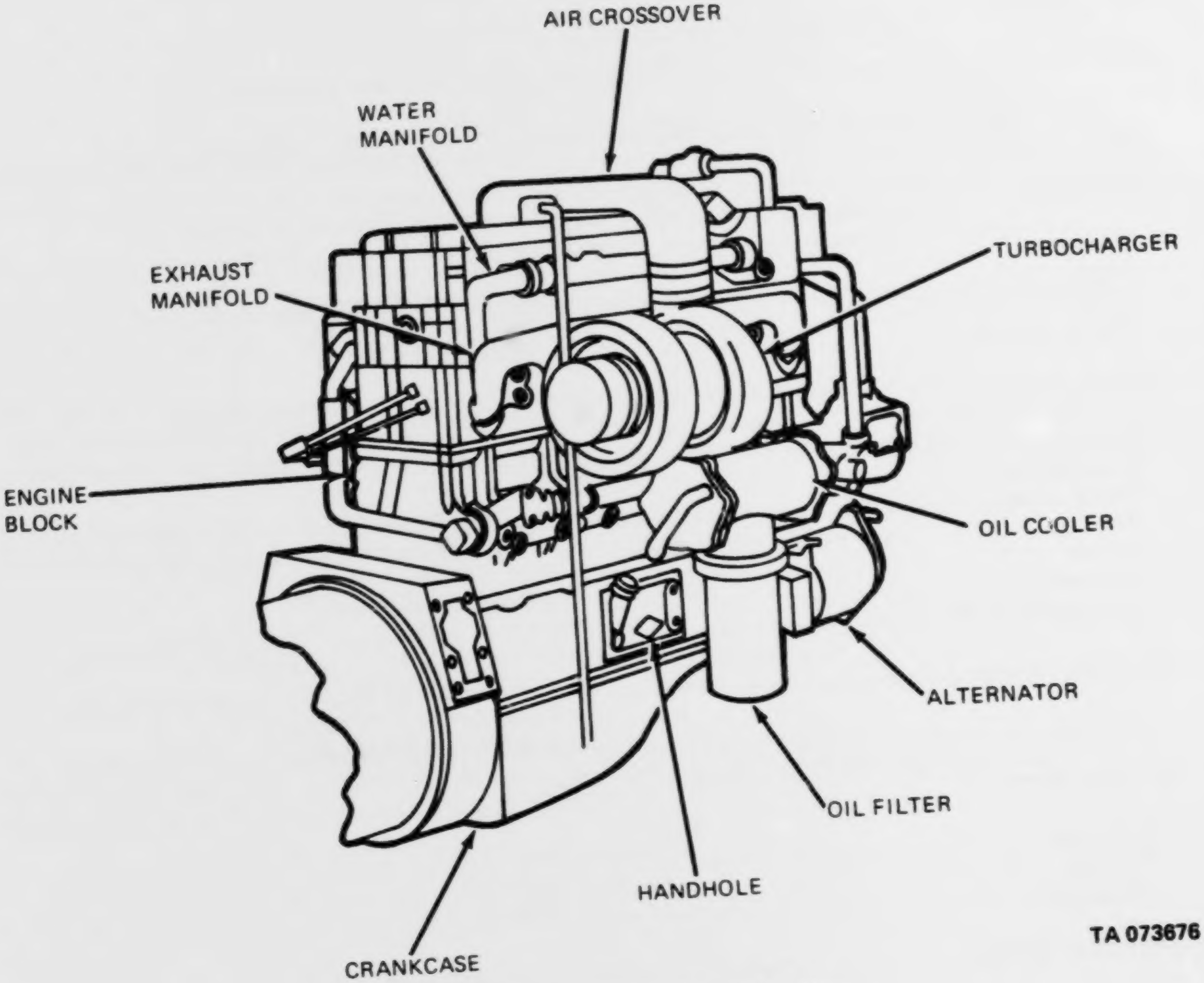

COOLANT OUTLET CROSSOVER
THERMOSTAT HOUSING
ETHER QUICK START
AFTER COOLER
FAN. CLUTCH AND HUB
ALCOHOL EVAPORATOR
STARTER
FUEL FILTER AND DRAINCOCK
FUEL INJECTION PUMP
VIBRATION DAMPER
AIR COMPRESSOR
POWER STEERING PUMP AND RESERVOIR
TA 073675

Figure 1-1. Engine Assembly, Left Side.


AIR CROSSOVER
WATER MANIFOLD
TURBOCHARGER
EXHAUST MANIFOLD
ENGINE BLOCK
OIL COOLER
ALTERNATOR
OIL FILTER
HANDHOLE
CRANKCASE

TA 073676

Figure 1-2. Engine Assembly, Right Side.

1-7. Tabulated Data:

Manufacturer	Cummins Engine Company, Inc.
Model	NTC-400
Type	4-cycle, turbocharged diesel, compression ignition
Dimensions:	
Length	58.88 in. (14.96 cm)
Width	33.63 in. (8.54 cm)
Height	50.91 in. (12.93 cm)
Net weight, dry	2600 lbs. (11.80 kg)
Cylinders:	
Number	6
Arrangement	Inline
Firing Order	1-5-3-6-2-4
Bore	5.5 in. (14.0 cm)
Stroke	6 in. (15.2 cm)
Displacement	855 cu in. (14 liters)
Compression ratio	13.5:1
Maximum Torque	1150 lb-ft @ 1500 rpm (159 kg-m @ 1500 rpm) (159 N·m @ 1500 rpm)
Governed Speed:	
Full Load	2100 rpm
No Load	2400 rpm
Idle Speed	600 rpm
Lubrication System:	
Type	Force fed
Operating pressure (normal)	50-70 psi (345-483 kPa)
Operating pressure (minimum)	15 psi (100 kPa) at idle
System Capacity including bypass filter	46 qts (43.5 liters)
Operating temperature (normal)	200°F-250°F (93°C-121°C)
Oil pump	Gear-type
Cooling System:	
Type	Liquid with fan and radiator
Operating temperature (normal)	175°F-195°F (79°C-91°C)
Thermostat	1

CHAPTER 2

DIRECT SUPPORT AND GENERAL SUPPORT MAINTENANCE INSTRUCTIONS

Section I. REPAIR PARTS, SPECIAL TOOLS, AND EQUIPMENT

2-1. Repair Parts, Tools, and Equipment. Repair parts, special tools, and test and support equipment are listed in appendix B.

2-2. Special Tools and Equipment. All illustrations pertaining to special tools and equipment are contained in appendix B of this manual. This is the authority for requisitioning of special tools and equipment necessary to perform the direct and general support maintenance operations.

2-3. Maintenance Repair. Repair parts required for the maintenance of the engine are listed in appendix B of this manual, which is the authority for requisitioning replacements.

Section II. TROUBLESHOOTING

2-4. General. Information in this chapter is for use of supporting maintenance personnel in conjunction with, and as a supplement to, the troubleshooting procedures in TM 9-2320-273-20. It provides a continuation of instructions given in TM 9-2320-273-20.

WARNING

Operation of a deadlined vehicle without a preliminary examination can cause further damage to a disabled component and possible injury to personnel. By careful inspection and troubleshooting, such damage and injury can be avoided. In addition, the causes of faulty operation of a vehicle or component can often be determined without extensive disassembly.

2-5. General Instructions and Procedures.

a. This section contains troubleshooting information for locating and correcting most of the operating troubles which may develop in the Cummins NTC-400 engine. Each malfunction for an individual component, unit or system is followed by a list of tests or inspections which will help you to determine corrective actions to take. You should perform the tests/inspections and corrective actions in the order listed. The troubleshooting chart will consider the engine to be mounted on a maintenance stand with the use of various test equipment.

b. Inspection after the engine is removed from the vehicle or maintenance stand is described in specific sections for removal and installation, and disassembly and assembly of the various components and subassemblies.

c. Table 2-1 lists possible malfunctions that may be experienced during the operation of the component on the maintenance stand. Each malfunction is followed by a list of probable causes that may be considered in determining their corrective action. You should perform the tests/inspections and corrective actions in the order listed.

NOTE

Before you use this table, be sure you have performed all applicable operative checks.

Table 2-1. Troubleshooting.

MALFUNCTION

TEST OR INSPECTION

CORRECTIVE ACTION

---

1. ENGINE WILL NOT CRANK.

Test for mechanical or hydraulic seizure.

Remove the fuel injectors (para 3-6 m. [1]). Turn the engine over several times to displace the liquid from cylinders through the injector openings. If the engine can be turned freely after all liquids have been displaced, install the injectors and start the engine. If the engine cannot be turned over freely by hand, disassemble the engine and replace the defective parts.

2. ENGINE CRANKS BUT FAILS TO START .

Step 1. Test for broken fuel supply pump drive shaft.

Replace the pump drive shaft (para 3-6, 3-91 and 3-162).

Step 2. Test for dirty or damaged injectors.

Replace the injectors (para 3-6 and 3-156).

Step 3. Test for defective fuel shutdown valve.

Replace the fuel shutdown valve (para 3-79 and 3-116).

Step 4. Test for faulty fuel pump.

Replace the fuel pump (3-6 and 3-162).

Step 5. Test for incorrect injector adjustment.

Adjust the injectors (para 3-163).

Step 6. Test for incorrect valve clearance.

Adjust the valves (para 3-163).

3. ENGINE STARTING MOTOR OPERATES, BUT DOES NOT ENGAGE THE FLYWHEEL RING GEAR.

Inspect for defective flywheel ring gear.

Replace the flywheel ring gear (3-6, 3-49 and 3-176).

Table 2-1. Troubleshooting (Cont'd)

MALFUNCTION

TEST OR INSPECTION

CORRECTIVE ACTION

---

4. ENGINE STOPS.

Step 1. Check if engine is overheated.

See item 6, below.

Step 2. Check for defective fuel shutdown valve.

Replace the fuel shutdown valve (para 3-79 and 3-116).

Step 3. Check for faulty fuel pump.

Replace the fuel pump (para 3-6 and 3-162).

5. ENGINE FAILS TO STOP.

Check for stuck fuel solenoid shutdown valve.

Replace the valve (para 3-79 and 3-116).

6. ENGINE OVERHEATS.

Check for faulty water pump.

Replace the water pump (para 2-9 and 3-184).

7. EXCESSIVE EXHAUST SMOKE.

Step 1. Check for defective fuel injector(s).

Replace the defective fuel injector(s) (para 3-6 and 3-156).

Step 2. Check for improperly seated valves.

Reseat or replace valves (para 3-31, 3-32, 3-33 and 3-34).

Step 3. Check for incorrect injector adjustment.

Adjust the injectors (para 3-163).

Step 4. Check for stuck Air Signal Attenuator (ASA) reverse flow valve.

Replace the ASA valve (para 3-121).

Table 2-1. Troubleshooting (Cont'd)

MALFUNCTION

TEST OR INSPECTION

CORRECTIVE ACTION

---

8. LOW OIL PRESSURE.

Step 1. Check pressure regulator.

Free-up the pressure regulator or replace the oil pump (para 3-6, 3-59 and 3-168).

Step 2. Check camshaft end play.

Replace the camshaft thrust bearing (para 3-6, 3-9 and 3-150).

Step 3. Inspect oil pump gasket.

Replace the gasket (para 3-6, 3-59 and 3-168).

Step 4. Check for worn camshaft.

Replace the camshaft (para 3-6 and 3-150).

Step 5. Check for worn crankshaft.

Replace the crankshaft and install new bearings (para 3-6, 3-14 and 3-147).

Step 6. Inspect main bearings.

Replace the main bearings (para 3-6, 3-18 and 3-147).

Step 7. Inspect connecting rod bearings.

Replace the connecting rod bearings (para 3-6, 3-18 and 3-149).

Step 8. Inspect oil pump gears.

Replace the oil pump (para 3-6, 3-59 and 3-168).

Step 9. Check for high oil temperature.

Inspect and clean oil cooler (para 3-6, 3-64 and 3-187).

Table 2-1. Troubleshooting (Cont'd)

MALFUNCTION

TEST OR INSPECTION

CORRECTIVE ACTION

---

9. ENGINE KNOCKS.

Step 1. Check for broken piston.

Replace the piston (para 3-6 and 3-149).

Step 2. Check for worn crankshaft.

Replace the crankshaft and install new bearings (para 3-6, 3-14 and 3-147).

Step 3. Check for excessive crankshaft end clearance.

Check the crankshaft end clearance (para 3-14).

Step 4. Check for incorrect injector adjustment.

Adjust the injectors (para 3-163).

Step 5. Check for incorrect valve adjustment.

Adjust the valves (para 3-163).

Step 6. Check for loose connecting rod capscrews.

a. Torque the connecting rod capscrews (para 3-149).

b. Check the bearings (para 3-18).

Step 7. Check for loose main bearing capscrews.

a. Torque the main bearing capscrews (para 3-147).

b. Check the bearings (para 3-18).

Step 8. Check for worn connecting rod bearings.

Replace the connecting rod bearings (para 3-6 and 3-149).

Step 9. Check for worn main bearings.

Replace the main bearings (para 3-6 and 3-147).

Step 10. Check for worn piston pins.

Replace the worn piston pins and bushing or replace rods (para 3-6, 3-20 and 3-149).

Table 2-1. Troubleshooting (Cont'd)

MALFUNCTION

TEST OR INSPECTION

CORRECTIVE ACTION

---

10. EXCESSIVE FUEL CONSUMPTION.

Step 1. Check for defective injector(s).

Replace the injector(s) (para 3-6 and 3-156).

Step 2. Check for incorrect valve and injector adjustment.

Adjust the valves and injectors (para 3-163).

Step 3. Check for leaking cylinder head gasket(s).

Replace the cylinder head gasket(s) (para 3-6 and 3-151).

11. EXCESSIVE OIL CONSUMPTION.

Step 1. Check for cracked piston.

Replace the damaged piston (para 3-6 and 3-149).

Step 2. Check for external leaks.

a. Tighten the external oil connections.
b. Replace the head gasket(s) (para 3-6 and 3-164).

Step 3. Check for worn piston(s) and cylinder liner(s).

Install new pistons and cylinder liners (para 3-6, 3-148 and 3-149).

Step 4. Check for worn, stuck, or broken piston rings.

Replace the piston rings (para 3-6 and 3-149).

12. EXCESSIVE ENGINE VIBRATION.

Step 1. Check for burned valves.

Replace the valves (para 3-33 and 3-34).

Step 2. Check for excessive flywheel runout.

Correct the flywheel runout (para 3-176).

Table 2-1. Troubleshooting (Cont'd)

MALFUNCTION

TEST OR INSPECTION

CORRECTIVE ACTION

---

12. EXCESSIVE ENGINE VIBRATION (Cont'd).

Step 3. Check for loose flywheel housing screws.

Tighten the flywheel housing screws (para 3-170).

Step 4. Check for loose flywheel mounting capscrews.

Tighten the flywheel mounting capscrews (para 3-176).

Step 5. Check for loose vibration damper.

Tighten the vibration damper capscrews (para 3-177).

Step 6. Check for vibration damper out of balance.

Install new vibration damper (para 3-6, 3-48 and 3-177).

Step 7. Check for misalinement of flywheel housing.

Aline the flywheel housing (para 3-171).

Step 8. Check for one or more injectors not performing properly.

Replace faulty injector(s) (para 3-6 and 3-156).

Step 9. Check for unbalanced flywheel.

Replace the flywheel (para 3-6, 3-49 and 3-176).

Step 10. Check timing for air compressor.

Retime air compressor (para 3-161).

13. ENGINE WILL NOT IDLE.

Step 1. Check for plugged governor barrel.

Clean the governor barrel (para 3-88).

Step 2. Check for stuck governor spring plunger.

Free the governor spring plunger (para 3-90).

Step 3. Check for improperly assembled spring pack.

Reassemble the spring pack correctly (para 3-110).

Table 2-1. Troubleshooting (Cont'd)

MALFUNCTION

TEST OR INSPECTION

CORRECTIVE ACTION

---

14. FUEL LEAKS AT FUEL PUMP OR INJECTOR.

Step 1. Check for faulty fuel filter gasket.

Replace the gasket (para 3-162).

Step 2. Check for faulty seals and O-rings in fuel pump.

Install new seals and O-rings (para 3-77).

Step 3. Check for mutilated injector O-rings.

a. Replace the injector cup O-ring (para 3-130).
b. Replace the injector mounting O-rings (para 3-156).

15. ENGINE DOES NOT DEVELOP FULL POWER.

Step 1. Check for dirty fuel injector(s).

Clean the fuel injectors (para 3-131).

Step 2. Check for worn or scored fuel pump components.

Repair or replace the fuel pump (para 3-6 and 3-162).

Step 3. Check for plugged electric shutoff valve.

Clean the electric shutoff valve (para 3-98).

Step 4. Check for plugged fuel pump throttle control shaft.

Clean or replace the fuel pump throttle control shaft (para 3-111).

Step 5. Check for improperly adjusted valves.

Adjust the valves (para 3-163).

Step 6. Check for improperly adjusted injector.

Adjust the injectors (para 3-163).

Step 7. Check for burned valves.

Reface or replace the valves and valve seats (para 3-33 and 3-34).

Step 8. Check for plugged Air Fuel Control (AFC) breather.

Replace the AFC breather (para 3-117).

Table 2-1. Troubleshooting (Cont'd)

MALFUNCTION

TEST OR INSPECTION

CORRECTIVE ACTION

---

16. ENGINE MISSES OR RUNS ERRATICALLY.

Step 1. Check for broken fuel injector plunger spring.

Replace the fuel injector plunger spring (para 3-130).

Step 2. Check for broken or deformed injector cup gasket.

Replace the injector cup gasket (para 3-130).

Step 3. Check for burned or excessively pitted valves.

Reface or replace the valves and valve seat inserts (para 3-33 and 3-34).

Step 4. Check for cracked or broken valve seat inserts.

Replace the damaged valve seat inserts (para 3-33 and 3-34).

Step 5. Check for leaking injector sleeves.

Replace the injector sleeves (para 3-33).

Step 6. Check for plugged injector cup spray holes.

Clean the injector cups (para 3-132).

Step 7. Check for plugged metering or drain orifice in fuel injectors.

Clean the fuel injectors (para 3-131).

Step 8. Check for improperly adjusted valves.

Adjust the valves (para 3-163).

17. EXCESSIVE GEAR NOISE.

Step 1. Check for broken or worn gear teeth.

Replace the gears or units having damaged teeth (para 3-6, 3-15, 3-27, 3-59 3-147, 3-150 and 3-179).

Step 2. Check for excessive gear backlash.

Replace the defective gears (para 3-6, 3-15, 3-27, 3-59, 3-147, 3-150 and 3-179).

Table 2-1. Troubleshooting (Cont'd)

MALFUNCTION

TEST OR INSPECTION

CORRECTIVE ACTION

18. EXCESSIVE OIL LOSS.

Step 1. Check for cracked or broken front gear case cover.

Replace the front gear case cover (para 3-6 and 3-154).

Step 2. Check for defective seals and gaskets.

Replace all faulty seals and gaskets as required.

Step 3. Check for leaking rear cover oil seal or gaskets.

Replace the rear cover oil seal or gasket (para 3-6 and 3-169).

19. SLUDGE FORMATION IN CRANKCASE.

Check for moisture in crankcase.

Isolate the source and repair as required.

20. LUBRICATING OIL DILUTED.

Step 1. Check for cracked or broken piston rings.

Replace the broken piston rings (para 3-6 and 3-149).

Step 2. Check for broken piston.

Replace the piston (para 3-6 and 3-149).

Step 3. Check for defective injector(s).

Repair or replace the injectors (para 3-6, 3-13 and 3-156).

21. LOW COMPRESSION.

Step 1. Check for worn piston rings.

Replace piston rings (para 3-6 and 3-149).

Step 2. Check for worn cylinder liners.

Replace cylinder liners (para 3-6 and 3-148).

Table 2-1. Troubleshooting (Cont'd)

MALFUNCTION

TEST OR INSPECTION

CORRECTIVE ACTION

21. LOW COMPRESSION (Cont'd).

Step 3. Check for valves not seating.

Reface valves and seats (para 3-33 and 3-34).

Step 4. Check for leaking cylinder head gasket.

Replace gasket (para 3-6 and 3-151).

22. ENGINE OVERSPEED.

Step 1. Check for improperly adjusted governor.

Adjust governor (para 3-206).

Step 2. Check for defective governor or fuel injection pump.

Repair governor or fuel injection pump as necessary (para 3-6 and 3-162).

Section III. GENERAL MAINTENANCE

2-6. General. This section covers draining the lubricating oil, coolant and fuel systems; cleaning the engine assembly; and preliminary inspection of the engine.

2-7. Preparation.

a. Lifting the Engine Assembly. Using a suitable sling attached to the lifting eyes, lift the engine for draining, cleaning and installation on a maintenance stand.

b. Draining. Using separate containers for each system:

(1) Remove the oil drain plug (fig. 2-1) from the aft-right hand side of the crankcase. Drain the oil system completely, then replace the plug.

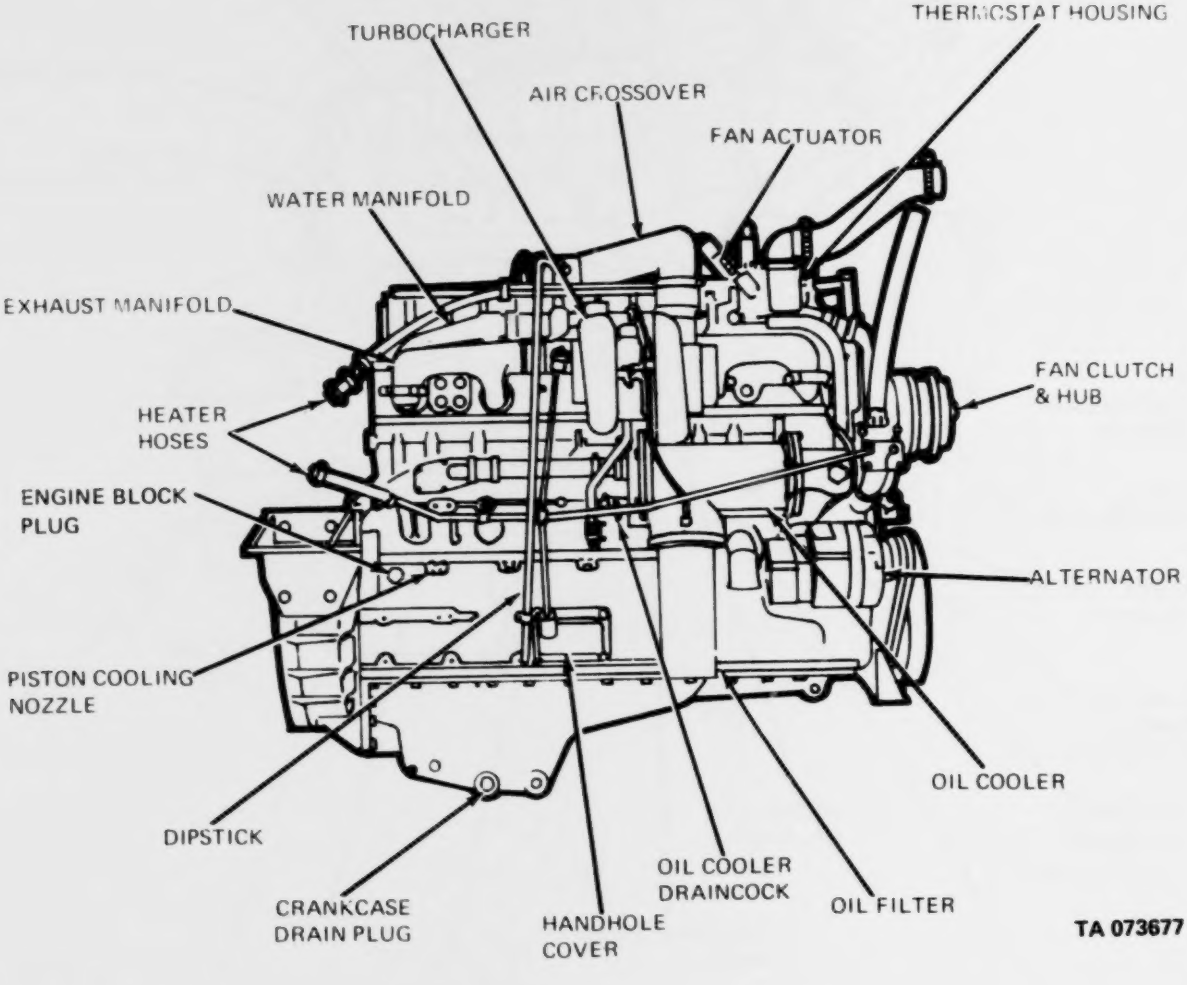
(2) Remove the engine block plug from the aft-right hand side of the block. Open the drain cock on the rear end of the oil cooler. Completely drain the coolant from the engine block and oil cooler. Close the drain cock and replace the engine block plug.

(3) Open the drain cock (fig. 2-2) on the bottom of the fuel filter. Completely drain the fuel from the filter. Close the drain cock.

c. Cleaning. Close all openings on the engine with waterproof tape or suitable plugs. Thoroughly clean all external parts and outer surfaces. Make sure no foreign material enters the working parts of the engine. Wash the engine using water under pressure to remove mud and dirt. Remove oil and grease using a stiff brush and drycleaning solvent.

2-8. Preliminary Inspection. After the engine has been thoroughly drained and cleaned, visually inspect the external components for bent, broken, and other damaged conditions. Mark the areas to serve as a guide in the repair or replacement of such parts.

2-9. Component Removal. Prior to mounting the engine on the automotive engine maintenance stand, remove the following components. (See figures 2-1 through 2-8.)


TURBOCHARGER
THERMOSTAT HOUSING
AIR CROSSOVER
FAN ACTUATOR
WATER MANIFOLD
EXHAUST MANIFOLD
FAN CLUTCH & HUB
HEATER HOSES
ENGINE BLOCK PLUG
ALTERNATOR
PISTON COOLING NOZZLE
OIL COOLER
DIPSTICK
OIL COOLER DRAINCOCK
CRANKCASE DRAIN PLUG
HANDHOLE COVER
OIL FILTER

TA 073677

Figure 2-1. Engine Assembly, Right Side

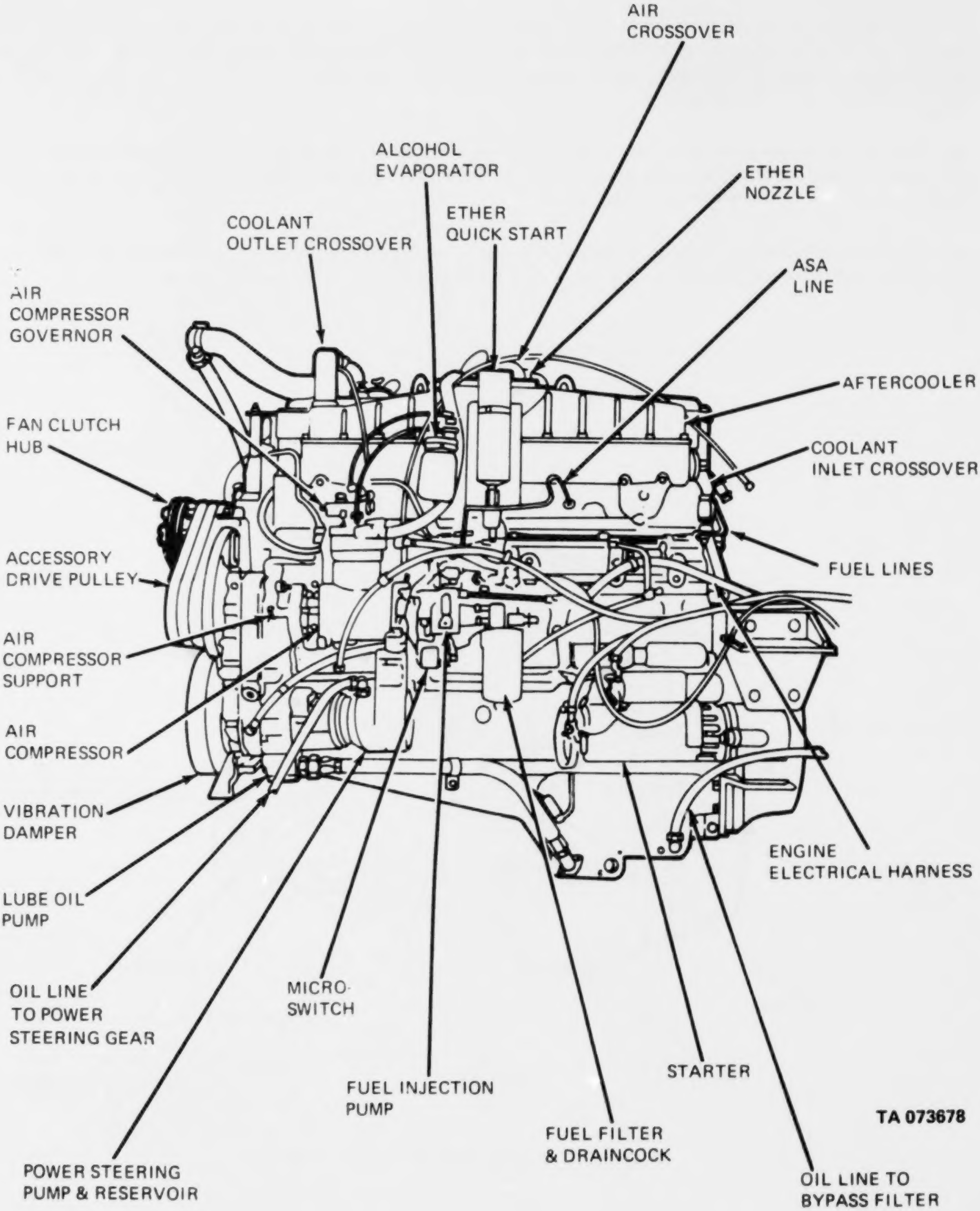

AIR CROSSOVER
ALCOHOL EVAPORATOR
ETHER NOZZLE
COOLANT OUTLET CROSSOVER
ETHER QUICK START
ASA LINE
AIR COMPRESSOR GOVERNOR
AFTERCOOLER
FAN CLUTCH HUB
COOLANT INLET CROSSOVER
ACCESSORY DRIVE PULLEY
FUEL LINES
AIR COMPRESSOR SUPPORT
AIR COMPRESSOR
VIBRATION DAMPER
ENGINE ELECTRICAL HARNESS
LUBE OIL PUMP
OIL LINE TO POWER STEERING GEAR
MICRO-SWITCH
STARTER
FUEL INJECTION PUMP
TA 073678
FUEL FILTER & DRAINCOCK
POWER STEERING PUMP & RESERVOIR
OIL LINE TO BYPASS FILTER

Figure 2-2. Engine Assembly, Left Side

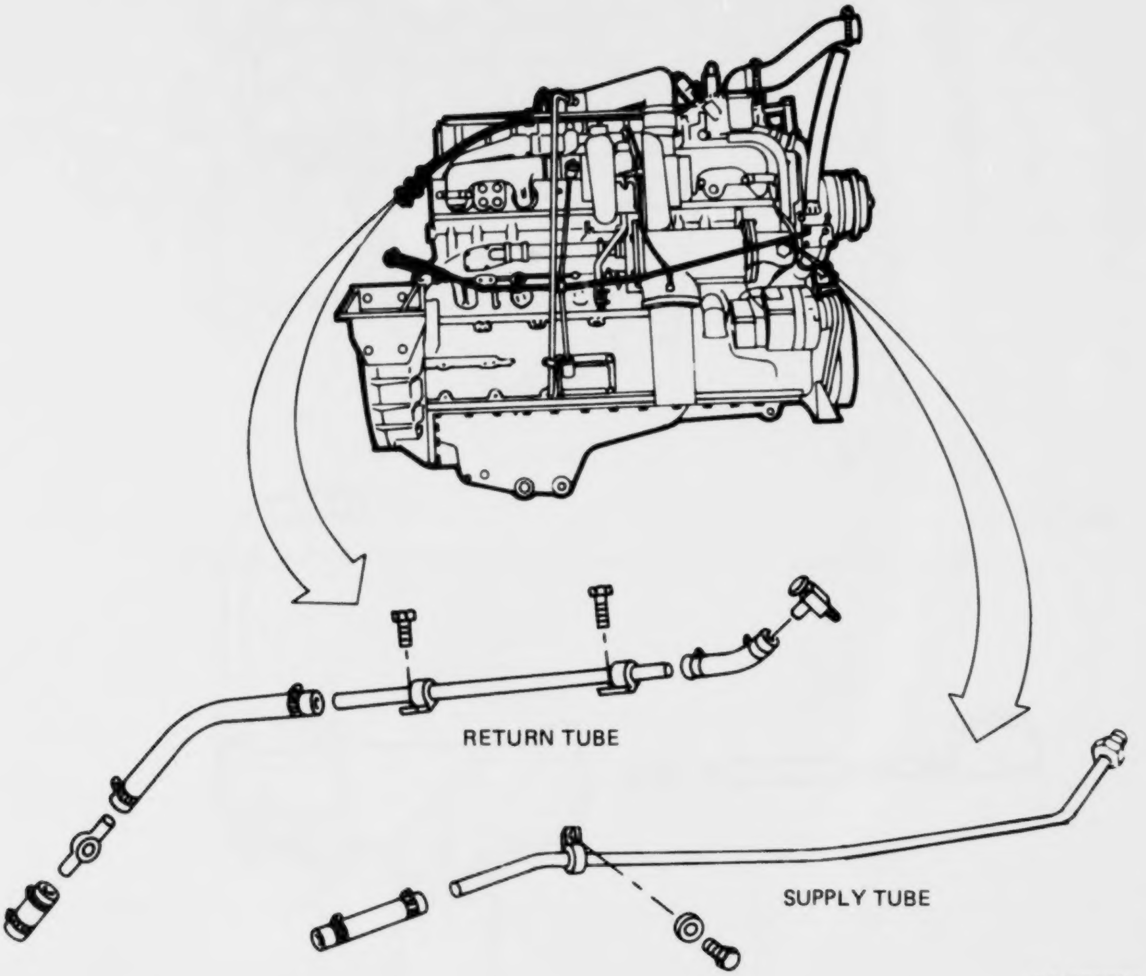
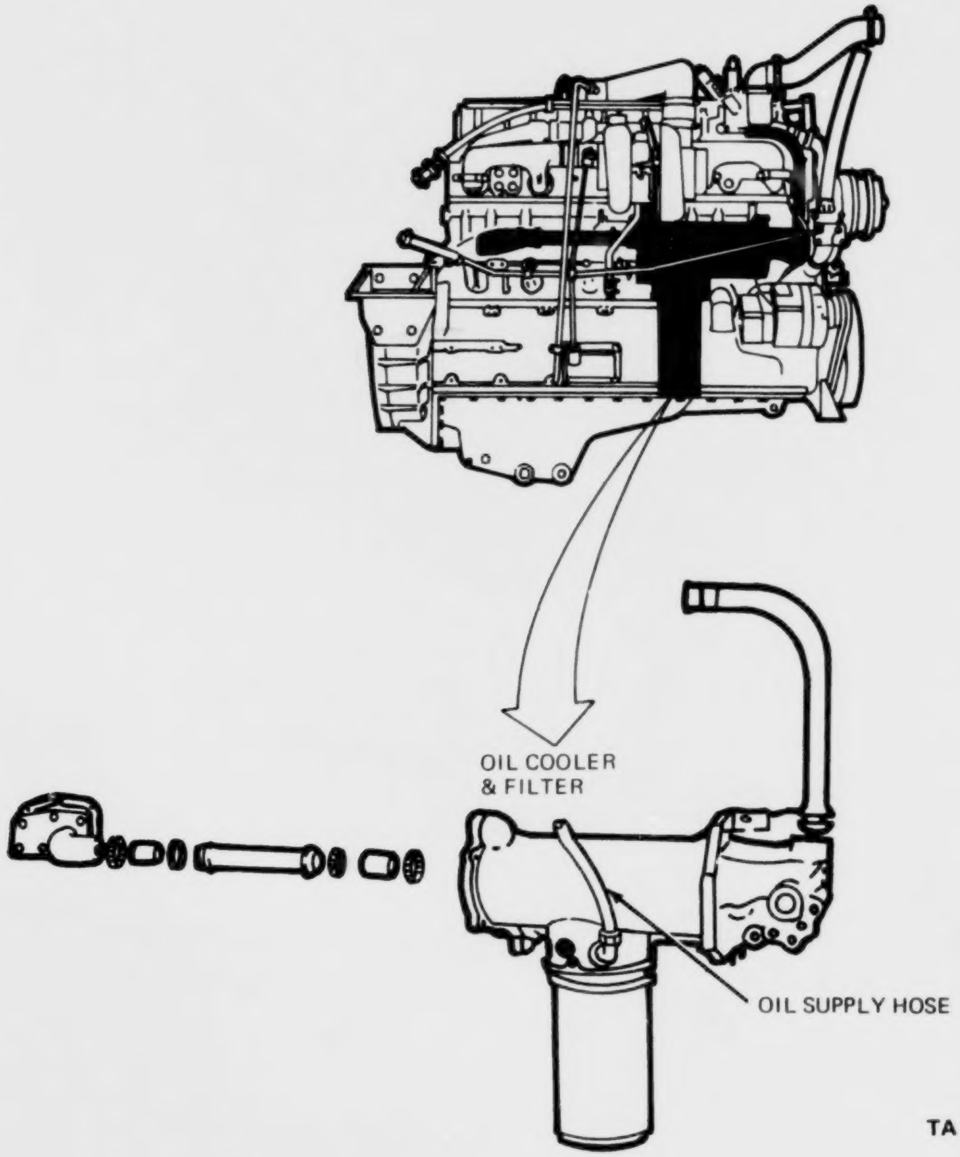
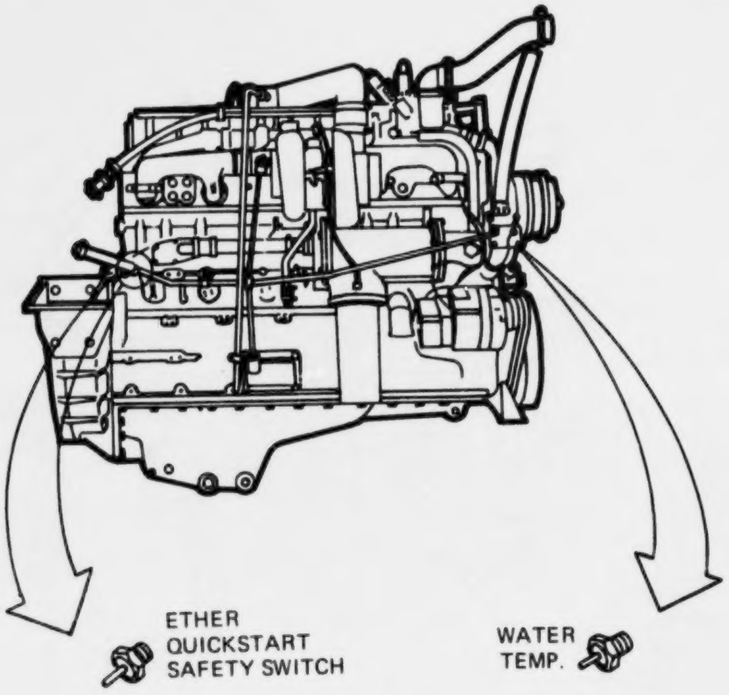

RETURN TUBE
SUPPLY TUBE
TA 073679

Figure 2-3. Heater Tubes.


OIL COOLER
& FILTER
OIL SUPPLY HOSE

TA 073680

Figure 2-4. Oil Cooler and Filter.


ETHER
QUICKSTART
SAFETY SWITCH
WATER
TEMP.

TA 073681

Figure 2-5. Ether Quick-Start Safety Switch and Water Temperature Sensor.

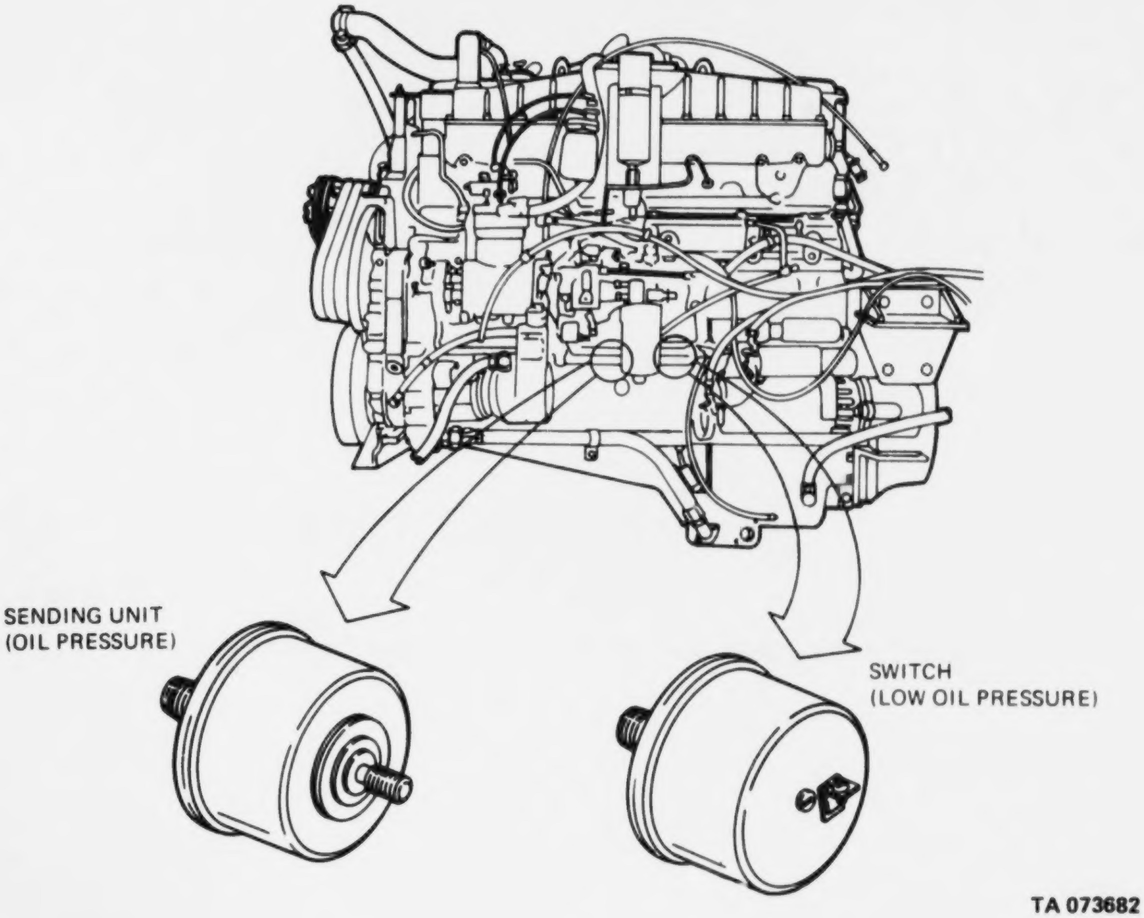

SENDING UNIT
(OIL PRESSURE)
SWITCH
(LOW OIL PRESSURE)
TA 073682

Figure 2-6. Oil Pressure and Low Oil Pressure Sending Units.

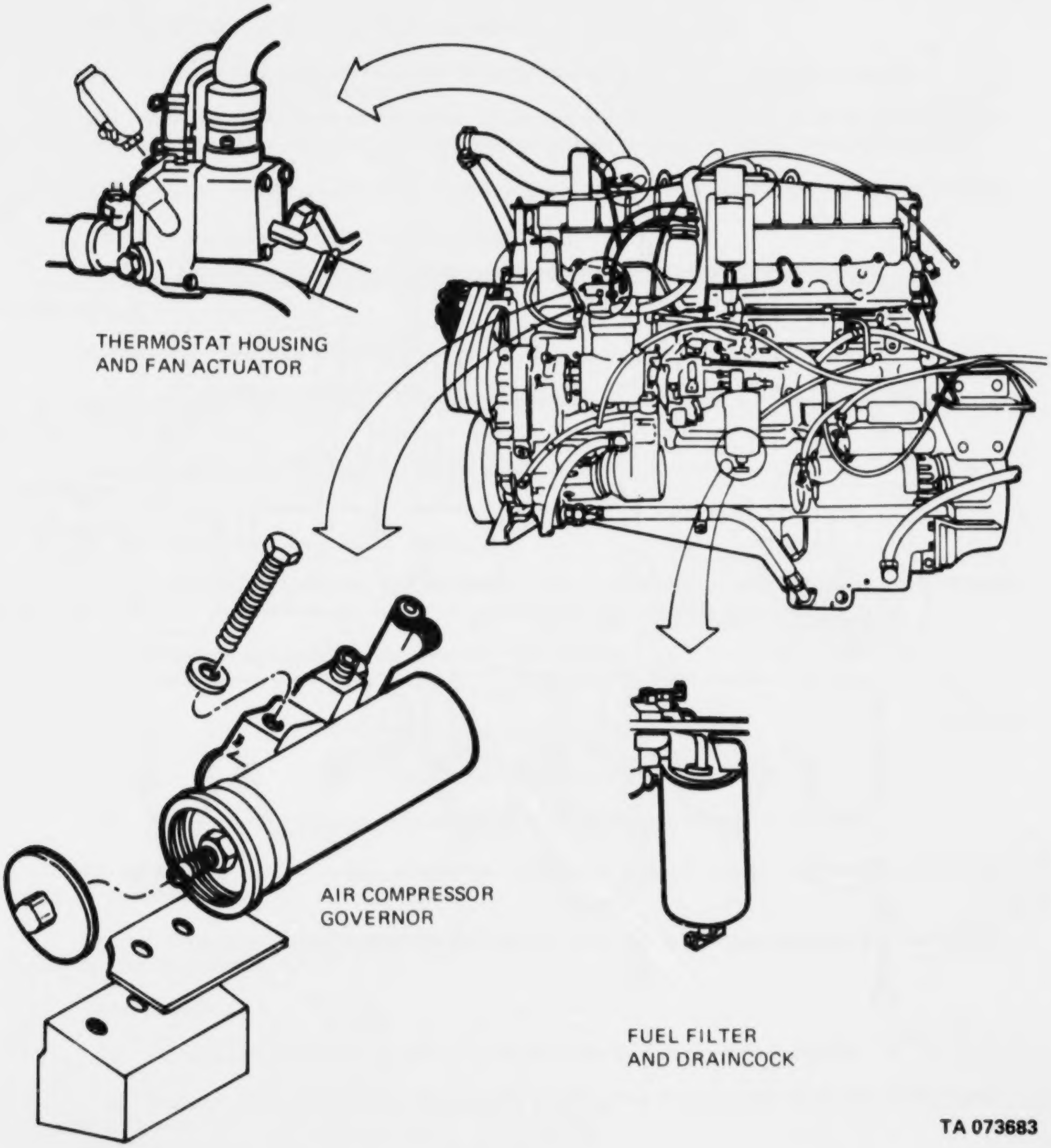
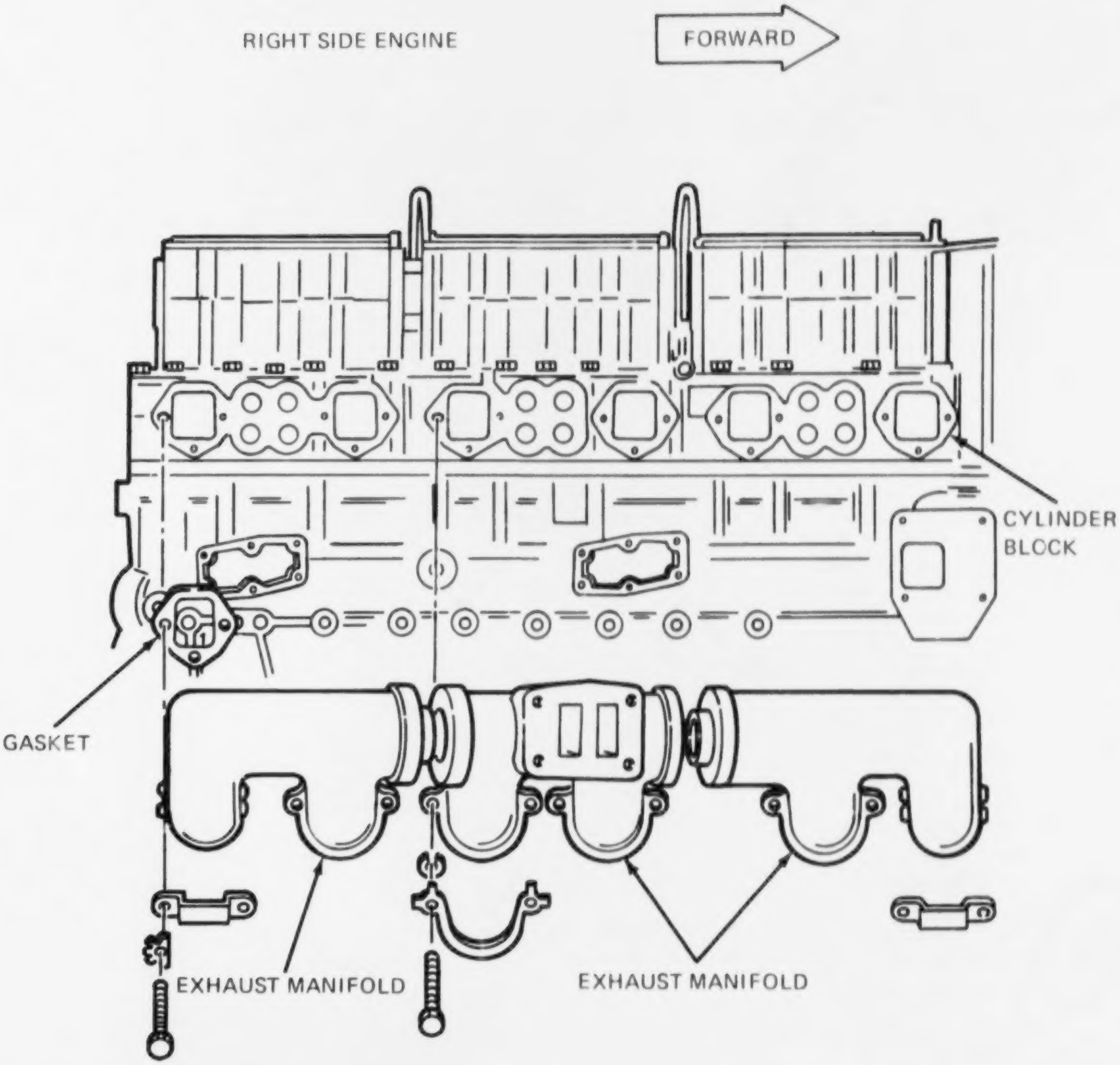

THERMOSTAT HOUSING
AND FAN ACTUATOR
AIR COMPRESSOR
GOVERNOR
FUEL FILTER
AND DRAINCOCK
TA 073683

Figure 2-7. Thermostat Housing, Air Compressor Governor, and Fuel Filter and Draincock.


RIGHT SIDE ENGINE
FORWARD
CYLINDER BLOCK
GASKET
EXHAUST MANIFOLD
EXHAUST MANIFOLD

TA 073793

Figure 2-8. Exhaust Manifold.

a. If vehicle is equipped with the optional engine coolant heater, remove hoses, lines and fittings (refer to TM 9-2320-273-20).

b. Oil Gage (Dipstick), Breather Tube and Hand Hole Cover (fig. 2-1).

(1) Remove the capscrews securing oil gage mounting bracket to the engine block.

(2) Remove the four capscrews and lockwashers securing the hand hole cover to the engine block. Remove the hand hole cover and dipstick assembly from the engine block. Discard the gasket.

(3) Remove the spring clip securing the breather tube to the breather cap on the valve cover.

(4) Pull the breather tube from the breather cap.

c. Fan. If the fan has not been removed, remove the capscrews securing it to the fan clutch assembly (fig. 2-1).

d. Turbocharger. Remove the turbocharger (fig. 2-1). Refer to TM 9-2320-273-34.

e. Heater Return Tube. Remove the heater return tube and brackets if necessary (fig. 2-3). Refer to TM 9-2320-273-20.

f. Heater Supply Tube. Remove the heater supply tube and brackets (fig. 2-3). Refer to TM 9-2320-273-20.

g. Exhaust Manifold.

(1) Remove the capscrews, lockwashers, lockplates and clamps securing exhaust manifold to engine (fig. 2-8).

(2) Remove exhaust manifold assembly from engine.

NOTE

When repairing or replacing sections of the
manifold assembly, apply heat to mating
collars to expand for ease of separation.

(3) Remove and discard exhaust manifold to engine block mounting brackets.

h. Air Compressor Coolant Lines. Disconnect the tubing between the water pump, bypass tube, and the air compressor.

i. Coolant Crossover Tube. Disconnect the coolant crossover tube from between the thermostat housing and the aftercooler.

j. Water Manifold.

(1) Remove the capscrews securing the water manifold to the engine block.

(2) Remove one capscrew and lockwasher securing the transfer pipe from the water manifold to the oil cooler.

(3) Remove the water manifold from the engine.

k. Thermostat Housing. Remove the thermostat housing (fig. 2-7). Refer to TM 9-2320-273-20.

l. Alternator Leads. Disconnect the electrical leads to the alternator, at the alternator.

m. Alternator. Remove the capscrews securing the alternator bracket to the engine (fig. 2-1). Remove the alternator and bracket. Also remove the alternator adjusting rod.

n. Oil Cooler/Filter Assembly and Connections (fig. 2-4).

(1) Remove the capscrews and lockwashers securing the angle bracket to the pressure oil cooler cover.

(2) Remove the capscrews that secure the water header connection to the engine.

(3) Disconnect the oil supply hose from the cooler to the turbocharger if necessary.

(4) Remove the capscrews and lockwashers securing the support to the block.

(5) Tap the oil cooler support with a plastic hammer and remove the oil cooler assembly from the engine.

(6) Remove the water header gasket, support gasket, and angle bracket from the engine.

o. Water Inlet Manifold.

(1) Remove the capscrews holding the water inlet to the water pump and remove the water inlet support bracket from the block.

(2) Remove the capscrews securing the water inlet manifold to the water pump. Disconnect the water temperature sensor wire (fig. 2-5). Remove the water inlet manifold.

p. Miscellaneous Nylon Tubing. Disconnect the small nylon tubes between the air compressor, alcohol evaporator, air compressor governor, fan actuator, and fan clutch.

q. Air Compressor Inlet Hose. Remove the hose from between the air intake and the air inlet of the air compressor.

r. Ether Quick-Start Line. Disconnect the ether quick-start line from the air crossover tube (fig. 2-2).

s. Air Line Support Bracket. Remove the bracket supporting the air line between the aftercooler and the ASA (Air Signal Attenuator) line on the fuel pump (fig. 2-2).

t. Alcohol Evaporator/Ether Quick-Start Mounting Bracket. Remove the capscrews securing the mounting bracket for the alcohol evaporator and ether quick-start assemblies to the aftercooler. The mounting bracket and assemblies are removed together.

u. Electrical Connections. Disconnect the wiring harness from the three engine retarder terminals; the oil pressure, low oil pressure warning, water temperature and ether quick-start safety switch sending units; the fuel shutoff solenoid and the engine retarder microswitch; and starter. Then unscrew oil pressure and low oil pressure warning sending units from engine (fig. 2-6).

v. Electrical Harness. Remove the capscrews securing the ground strap and electrical harness to the engine. Remove the harness and ground strap.

w. Fan Clutch. Remove the four capscrews securing the fan clutch support bracket to the front gear cover. Remove the fan clutch assembly (fig. 2-1 and 2-2).

CAUTION

The ceramic water pump impeller is
easily damaged. Carefully remove it
from the water pump cavity.

x. Water Pump and Idler Pulley. Loosen the idler pulley adjusting screw and slide pulley up to expose capscrew. Remove the six capscrews and dismount water pump assembly.

y. Power Steering Pump. Remove the two capscrews securing the power steering pump to the lubricating oil pump. Remove the top hose if necessary on the power steering pump. Refer to TM 9-2320-273-20.

z. Starter. Remove the starter (fig. 2-2). Refer to TM 9-2320-273-20.

aa. Piston Cooling Nozzles. Remove the six piston cooling nozzles and discard O-rings (fig. 2-1).

2-10. Install the Engine on a Maintenance Stand. After removal of the components as outlined in paragraph 2-9, move the engine to a suitable maintenance stand. Mount the engine to the stand, remove the lifting slings and proceed with engine service.

CHAPTER 3

REPAIR OF ENGINE ASSEMBLY

Section I. GENERAL

3-1. Purpose. The purpose of this chapter is to provide complete instruction for the repair of engine subassemblies. General procedures are provided which are applicable to all operations, followed by detailed instructions for each subassembly. General procedures for cleaning, inspection, repair, and assembly are outlined below.

3-2. Cleaning.

a. General. The procedures for cleaning will be the same for most parts and components which comprise the engine subassemblies. To avoid repetition of instructions, the general procedures for cleaning are detailed in *b* through *f*, below. Any cleaning procedures which are peculiar to a specific part or component are covered in the section or paragraph relating to the item.

b. Cleaning Instructions. The importance of cleaning must be thoroughly understood by maintenance personnel. Great care and conscientious effort are required in all cleaning operations. The presence of dirt or foreign substances is a constant threat to satisfactory engine operation and maintenance. The following should apply to all cleaning operations:

(1) Clean all parts before inspection, after repair, and before assembly.

(2) Hands should be kept free of any accumulation of grease which can collect dust and grit.

(3) After cleaning, all parts should be covered or wrapped in plastic or suitable paper to protect them from dust and dirt.

c. Castings.

(1) Clean inner and outer surfaces of castings and all areas subject to oil and grease with drycleaning solvent.

(2) Remove sludge and gum deposits from castings, using a stiff brush.

WARNING

Compressed air used for cleaning purposes will not exceed 30 psi. Use only with effective chip guarding and personal protective equipment (goggles/shield, gloves, etc.)

(3) Use clean, dry, compressed air to blow out and dry all tapped holes in castings.

d. Oil Passages. Particular attention must be given to all oil passages in castings and machine parts. All oil passages must be clean and free of obstructions.

(1) Clean passages with wire or a suitable probe to break up any sludge or gum deposits.

CAUTION

Do not allow drycleaning solvents to come in contact with seals or flexible hoses. These cleaners cause leather, rubber, and synthetic materials to dry out, rot, and lose pliability.

(2) Wash passages by flushing with drycleaning solvent.

(3) Dry passages by blowing them out with compressed air.

e. Oil Seals and Flexible Hoses. Clean seals and flexible hoses with soap and water.

f. Ball Bearings.

(1) Refer to TM 9-214 for information on care and maintenance of bearings.

(2) Bearings require special cleaning. After removing surface oil and gum deposits, place bearings in 140°F (60°C) hot oil to loosen congealed oil and grease. Wipe bearings dry; do not use compressed air. After cleaning, coat bearings with a light film of oil, and wrap in paper until parts are inspected and assembled.

3-3. Inspection.

a. General. Procedures for inspection will be the same for most parts and components which comprise the engine subassemblies. To avoid repetition of instructions, the general procedures for inspection are detailed in *b* through *h*, below. Any inspection procedures which are peculiar to a specific part or component are covered in the section or paragraph relating to that item.

b. Castings.

(1) Inspect all ferrous and nonferrous castings for cracks using a magnifying glass and strong light. Particularly check the areas adjacent to studs, pipe plugs, threaded inserts, and in sharp corners and fillets.

(2) Inspect machined surfaces of castings for nicks, burrs, and raised metal. Mark damaged areas for repair.

(3) Check all mating flanges on housings and supports for warpage with a straightedge or on a surface plate. Inspect mating flanges for discoloration which may indicate persistent oil leakage.

(4) Inspect all pipe plug and capscrew-tapped openings for damaged or stripped threads.

(5) Check all castings for conformance to applicable repair standards (table 3-1).

c. Ball Bearings. Refer to TM 9-214 for inspection of bearings. Check all bearings for conformance to applicable repair standards (table 3-1).

Table 3-1. Repair Standards.

Measurement	Wear Limit	New Minimum	New Maximum
CYLINDER BLOCK SPECIFICATIONS – INCH (mm)			
Camshaft Bushing Inside Diameter	2.5018 (63.546)	2.4983 (63.457)	2.5008 (63.520)
Camshaft Bushing Bore Inside Diameter		2.6245 (66.662)	2.6255 (66.688)
Cylinder Liner Counterbore Inside Diameter		6.5615 (166.662)	6.5635 (166.713)
Depth	0.413 (10.46)	0.350 (8.89)	0.352 (8.94)
Liner to Block Clearance Lower Bore		0.002 (0.05)	0.006 (0.15)
Lower Liner Bore Inside Diameter		6.124 (155.55)	6.126 (155.60)
Main Bearing Bore Inside Diameter	4.7505 (120.663)	4.7485 (120.612)	4.750 (120.650)
Height from Main Bearing Centerline	18.994 (482.45)	19.003 (482.68)	19.007 (482.78)
Height from Installed Alinement Bar	16.619 (422.12)	16.628 (422.35)	16.632 (422.45)
Cylinder Liner Inside Diameter	5.505 (139.83)	5.4995 (139.687)	5.501 (139.73)

NOTE

New cylinder liner dimensions at 60°F–70°F (16°C-21°C); may be 0.0002-0.0006 inch (0.005-0.015 mm) smaller than indicated due to the lubrite coating.

Protrusion (Installed)		0.003 (0.08)	0.006 (0.15)

Table 3-1. *Repair Standards. (Continued)*

Measurement	Wear Limit	New Minimum	New Maximum
CYLINDER BLOCK SPECIFICATIONS – INCH (mm) (Continued)			
Crankshaft			
Connecting Rod Journal Outside Diameter	3.122 (79.30)	3.1235 (79.337)	3.125 (79.38)
Main Bearing Journal Outside Diameter	4.4975 (114.237)	4.4985 (114.262)	4.500 (114.30)
Thrust Bearing Surface to Rear Counterweight	3.006 (76.35)	3.001 (76.23)	3.003 (76.28)
Main and Rod Journals Out-of-Round T I R *	0.002 (0.05)		
Main and Rod Journal Taper (Length of Journal)	0.0005 (0.013)		
Main Bearings			
Shell Thickness	0.1215 (3.086)	0.123 (3.12)	0.1238 (3.145)
Journal Clearance	0.007 (0.18)	0.0015 (0.038)	0.005 (0.13)
Rod Bearings			
Shell Thickness	0.093 (2.36)	0.0942 (2.393)	0.0947 (2.405)
Journal Clearance	0.007 (0.18)	0.0015 (0.038)	0.0045 (0.114)
Crankshaft Thrust Ring 157280 Std			
Thickness	**	0.245 (6.22)	0.247 (6.27)
Crankshaft End Clearance			
End Clearance (Installed)	0.022 (0.56)	0.007 (0.18)	0.017 (0.43)
Connecting Rod			
Crankpin Bore Inside Diameter		3.3160 (84.226)	3.3165 (84.239)
Center to Center Length		11.998 (304.75)	12.000 (304.80)

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* T I R = Total Indicated Runout

** Use Crankshaft End Clearance

Table 3-1. Repair Standards. (Continued)

Measurement	Wear Limit	New Minimum	New Maximum
CYLINDER BLOCK SPECIFICATIONS – INCH (mm) (Continued)			
Piston Pin Bushing			
Inside Diameter	2.0022 (50.856)	2.001 (50.83)	2.0015 (50.838)
Connecting Rod			
Bend (without Bushing)	0.004 (0.10)		0.004 (0.10)
Bend (with Bushing)	0.0015 (0.038)		0.0015 (0.038)
Twist (without Bushing)	0.007 (0.18)		0.007 (0.18)
Twist (with Bushing)	0.004 (0.10)		0.004 (0.10)
Connecting Rod Capscrew			
Minimum Outside Diameter	0.583 (14.81)	0.584 (14.83)	0.590 (14.99)
Cap Outside Diameter	0.637 (16.18)	0.638 (16.21)	0.643 (16.33)
Dowel and Pilot (2-Capscrew Rod)			
Dowel Diameter		0.3127 (7.849)	
Rod Dowel Hole		0.3128 (7.851)	0.3133 (7.864)
Dowel Protrusion		0.220 (5.52)	0.250 (6.28)
Dowel Press Fit-In Cap		0.0001 (0.003)	0.0006 (0.015)
Piston			
Skirt Diameter at 70°F (21°C)	5.483 (139.27)	5.487 (139.37)	5.488 (139.40)
Piston Pin Bore			
Inside Diameter at 70°F (21°C)	1.999 (50.775)	1.9985 (50.762)	1.9990 (50.775)
Piston Pin			
Outside Diameter	1.9985 (50.762)	1.99875 (50.768)	1.9990 (50.775)

Table 3-1. Repair Standards. (Continued)

Measurement	Wear Limit	New Minimum	New Maximum
CYLINDER BLOCK SPECIFICATIONS – INCH (mm) (Continued)			
Piston Ring Part No. 147670 Gap in Ring Travel Area of Liner	***	0.023 (0.56)	0.033 (0.85)
Piston Ring Part No. 132880 Gap in Ring Travel Area of Liner	***	0.019 (0.48)	0.029 (0.74)
Piston Ring Part No. 214730 Gap in Ring Travel Area of Liner	***	0.019 (0.48)	0.029 (0.74)
Piston Ring Part No. 218732 Gap in Ring Travel Area of Liner	***	0.010 (0.25)	0.025 (0.64)
Camshaft Journal Outside Diameter	2.495 (63.37)	2.496 (63.40)	2.497 (63.42)
Thrust Bearing Thickness	0.083 (2.11)	0.093 (2.36)	0.098 (2.49)
Support Bushing Inside Diameter	1.370 (34.80)	1.3725 (34.862)	1.3755 (34.938)
Outboard Bearing Support Inside Diameter	1.757 (44.63)	1.751 (44.48)	1.754 (44.55)
Gear Case Cover – Accessory Drive Bushing Part No. Std. Inside Diameter	1.571 (39.90)	1.565 (39.75)	1.569 (39.85)

***Add 0.003-inch (0.08 mm) ring gap to new maximum limit for each 0.001-inch (0.03 mm) wear in cylinder liner wall.

Table 3-1. Repair Standards. (Continued)

Measurement	Wear Limit	New Minimum	New Maximum
CYLINDER HEAD SPECIFICATIONS – INCH (mm)			
Cylinder Head Height	4.340 (110.24)	4.370 (111.00)	4.380 (111.25)
Valve, Stem (1) Outside Diameter	0.449 (11.41)	0.450 (11.43)	0.451 (11.46)
Face Angle (2)		30°	30°
Valve Guide (3) Inside Diameter	0.455 (11.56)	0.4525 (11.494)	0.4532 (11.511)
Assembled Height (4)		.270 (32.36)	.280 (32.51)
Valve Seat Insert (5) Outside Diameter		2.0025 (50.864)	2.0035 (50.889)
Cylinder Head (6) Inside Diameter		1.9995 (50.787)	2.0005 (50.813)
Insert Height (7)		1.278 (7.06)	2.282 (7.16)
Run Out in 360° (8)	0.002 (0.05)		
Refaced Seat Width (9)		0.063 (1.59)	0.125 (3.18)
Valve Spring Assembled Height			2.250 (57.15)
Crosshead Guide Outside Diameter	0.432 (11.18)	0.433 (11.00)	0.4335 (11.011)
Assembled Height		1.860 (47.24)	1.880 (47.75)
Injector Sleeve Tip Protrusion		0.060 (1.52)	0.070 (1.78)

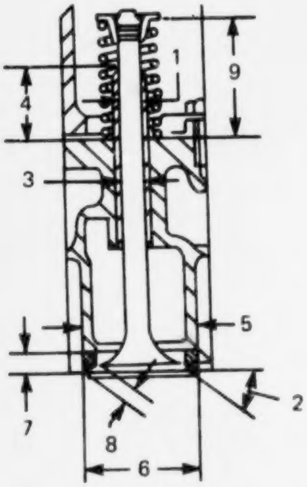


Table 3-1. Repair Standards. (Continued)

Measurement	Wear Limit	New Minimum	New Maximum
ROCKER LEVER SPECIFICATIONS – INCH (mm)			
Bushing			
Inside Diameter	1.1286 (28.664)	1.1245 (28.562)	1.1275 (28.639)
Shaft			
Outside Diameter	1.122 (28.50)	1.123 (28.52)	1.124 (28.55)
CAM FOLLOWER SPECIFICATIONS – INCH (mm)			
Shaft			
Outside Diameter	0.748 (19.00)	0.7485 (19.012)	0.7490 (19.02)
Bushing			
Inside Diameter	0.752 (19.10)	0.7501 (19.053)	0.7511 (19.078)
Injector Cam Roller			
Inside Diameter	0.705 (17.91)	0.703 (17.86)	0.704 (17.88)
Outside Diameter	1.2485 (31.71)	1.2495 (31.73)	1.2505 (31.76)
Valve Cam Rollers			
Inside Diameter	0.503 (12.78)	0.5005 (12.773)	0.5015 (12.708)
Outside Diameter	1.2485 (31.71)	1.2495 (31.73)	1.2505 (31.76)
Cam Roller Pin Diameter			
Valve	0.497 (12.62)	0.4995 (12.687)	0.500 (12.70)
Injector	0.697 (17.70)	0.6995 (17.767)	0.7000 (17.780)
LUBRICATING OIL PUMP SPECIFICATIONS – INCH (mm)			
Bushings			
Inside Diameter	0.879 (22.33)	0.8767 (22.268)	0.8777 (22.293)
Idler and Drive Shaft			
Outside Diameter	0.874 (22.20)	0.8745 (22.212)	0.875 (22.22)

Table 3-1. Repair Standards. (Continued)

Measurement	Wear Limit	New Minimum	New Maximum
LUBRICATING OIL PUMP SPECIFICATIONS – INCH (mm) (Continued)			
Drive Gear to Body			
Clearance	0.012 (0.30)	0.060 (1.50)	0.070 (1.80)
Drive Shaft			
End Play		0.002 (0.05)	0.008 (0.20)
Idler Shaft			
Shaft Protrusion (Above Body to Cover Face)		.938 (23.81)	1.0 (25.4)
Driven Gear/Drive Shaft			
Shaft Protrusion		1.035 (26.29)	1.055 (26.80)
Piston Cooling Oil Tube			
Protrusion Above Body (Mounting Face)		2.970 (75.44)	3.000 (76.20)
Filter/Cooler Pressure Regulator Spring			
Free Length			3.410 (86.36)
Load at 2.125 inch (53.98 mm) lb (N)		45 (200)	50 (222)
Recommended Oil Pressure psi (kPa)		45 (276)	70 (517)
COOLING SYSTEM SPECIFICATIONS – INCH (mm)			
Water Pump			
Impeller to Shaft Press-Fit	0.001 (0.03)		
Impeller to Body Clearance		0.020 (0.51)	0.040 (1.02)
Fan Hub			
End Clearance		0.003 (0.08)	0.015 (0.38)
Bearing to Shaft Press-Fit		0.000 (0.00)	0.001 (0.03)

Table 3-1. Repair Standards. (Continued)

Measurement	Wear Limit	New Minimum	New Maximum
COOLING SYSTEM SPECIFICATIONS – INCH (mm) (Continued)			
Thermostats	*Operating Range*	*Opening Travel*	
Ventless, Bypass	175°F (79°C) 195°F (91°C)	0.375 inch minimum (9.53 mm) minimum	
DRIVE UNIT SPECIFICATIONS – INCH (mm)			
Shaft Outside Diameter	0.499 (12.67)	0.4995 (12.687)	0.5005 (12.712)
Bushing Inside Diameter	0.5035 (12.789)	0.501 (12.73)	0.502 (12.78)
ASSEMBLY SPECIFICATIONS – INCH (mm)			
Main Bearing Journal Clearance	0.007 (0.18)	0.0015 (0.038)	0.005 (0.13)
Connecting Rod Bearing Journal Clearance	0.007 (0.18)	0.0015 (0.038)	0.0045 (0.114)
Crankshaft End Clearance	0.022 (0.56)	0.007 (0.18)	0.017 (0.43)
Cylinder Liner Protrusion		0.003 (0.08)	0.006 (0.15)
Out of Round (Top One (1) Inch)			0.003 (0.08)
Out of Round (Packing Ring (Lower) Area)			0.002 (0.05)
Connecting Rod Side Clearance		0.0045 (0.114)	0.013 (0.33)
Gear Train (Gear-to-Gear) Crankshaft, Camshaft, Accessory Drive and Lubricating Oil Pump Backlash	0.020 (0.51)	0.0045 (0.114)	0.0105 (0.267)

Table 3-1. Repair Standards. (Continued)

Measurement	Wear Limit	New Minimum	New Maximum
ASSEMBLY SPECIFICATIONS – INCH (mm) (Continued)			
Camshaft (with Thrust Plate)			
End Clearance		0.001 (0.03)	0.005 (0.13)
Camshaft (with Outboard Bearing Support)			
End Clearance		0.008 (0.20)	0.013 (0.33)

d. Studs. Inspect all studs for stripped or damaged threads, bent or loose condition, and evidence of stretching.

e. Gears.

(1) Inspect all gears for cracks, using a magnifying glass and a strong light.

(2) Inspect all gear teeth for wear, sharp fins, burrs, and galled or pitted surfaces.

(3) Check all gears for conformance to applicable repair standards (table 3-1).

f. Bushing and Bushing-Type Bearings.

(1) Check all bushing and bushing-type bearings for secure fit in their respective casting or mating part, and for evidence of heating which may be indicated by discoloration of bushing or bearing surface.

(2) Inspect bushings and bushing-type bearings for wear, burrs, nicks, and out-of-round condition.

(3) Check for dirt in lubrication holes or grooves of bushings or bushing-type bearings. Holes and grooves must be clean and free from damage to insure proper lubrication.

(4) Check all bushings and bushing-type bearings for conformance to applicable repair standards (table 3-1).

g. Oil Seals. Metal-encased oil seals should not be replaced unless inspection indicates damage.

(1) Inspect feather edge of oil seal for damage.

(2) Check seal for loss of pliability and resiliency.

h. Core Hole Plugs. Inspect core hole plugs for evidence of leakage. Replace seals if they are damaged or if leakage is evident.

3-4. Repair.

a. General. Procedures for repair will be the same for most parts and components which comprise the engine subassemblies. To avoid repetition of instructions, general procedures for repair are detailed in *b* through *g*, below. Any repair procedures which are peculiar to a specific part or component are covered in the section or paragraph relating to that item. After repair, clean all parts thoroughly to prevent metal chips or abrasives used in repair operations from entering working parts of the engine.

b. Castings.

(1) Replace all cracked castings.

(2) Replace all castings which do not conform to tolerances specified in repair standards in table 3-1.

(3) Repair minor damage to machined surfaces with a fine file, emery cloth, or crocus cloth dipped in drycleaning solvent. Replace all castings on which machined surfaces are burred or nicked to the point of impairing subsequent assembly or operation.

(4) Repair minor warpage of mounting flanges and gasket surfaces by working the surface across a sheet of emery cloth held tightly on a surface plate or a similar flat surface. Finish similarly with crocus cloth. Replace castings having flanges which are warped to the point of impairing assembly or operation.

(5) Repair damaged pipe or capscrew threads in tapped holes with a tap.

NOTE

Pipe plug threads in castings must be in good condition to prevent oil or water leakage.

c. Ball Bearings.

(1) Replace all galled, pitted, or damaged ball bearings.

(2) Replace all ball bearings which do not conform to tolerances specified in repair standards (table 3-1).

(3) Refer to TM 9-214 for maintenance of bearings.

d. Studs. Replace all bent or loose studs and studs showing evidence of stretching. Repair minor thread damage with a thread chaser. Replace all studs having stripped or damaged threads. Remove and replace studs as outlined in *(1)* and *(2)*, below.

(1) Removal. Using a stud extractor, back the studs out slowly to avoid heating and possible seizure. When the studs are broken off too short to use a stud extractor, drill the stud and extract it with an easy out.

(2) Replacement. Only standard studs are supplied for replacement. If threaded openings are damaged and retapping will not clean up threads, drill and tap opening in casting and install a threaded insert.

NOTE

All replacement studs have a special coating and must have a small amount of mica-base antiseize compound (MIL-A-13881) applied on the threads before the stud is installed in the casting.

e. Gears.

(1) Replace all cracked gears.

(2) Replace all gears which do not conform to tolerances specified in the repair standards in table 3-1.

(3) Replace gears having worn, pitted, or galled teeth. Remove sharp fins and burrs from gear teeth with crocus cloth dipped in drycleaning solvent.

f. Bushings and Bushing-Type Bearings. When bushings and bushing-type bearings are damaged or worn beyond specified limits, the associated parts with which they are used must also be replaced.

g. Oil Seals. Oil seals must be replaced when the thin feather edge is damaged or when the seal material has become hard or brittle.

(1) Removal. Press or pry a damaged oil seal from the casting or adapter, being careful not to damage the bore in the casting or adapter.

(2) Repair. When a casting oil seal bore or adapter is burred to a point where an oil-tight seal is impossible, replace the casting or adapter. Remove slight nicks, burrs, and scratches from the casting bore or adapter with crocus cloth dipped in drycleaning solvent.

(3) Installation. Install a new oil seal in the bore of the casting or adapter using a proper oil seal replacer tool.

3-5. Assembly Instructions.

a. General. Extreme care must be exercised in all component assembly operations to insure satisfactory engine performance. Precautionary rules for assembly are outlined below. Step-by-step procedures for assembly of various components are covered in the paragraph relating to the specific component.

b. Precautionary Rules.

(1) Cleanliness is essential in all component assembly operations. Dirt and dust, even in minute quantities, are abrasive. Parts must be cleaned, as specified, and kept clean. Wrap or cover parts and components when assembly procedures are not immediately completed.

(2) Coat all bearings and contact surfaces with engine oil OE/HDO-10 (MIL-L-2104C) to insure lubrication of parts during initial engine starting.

(3) Replace all gaskets and preformed packings during assembly.

c. Teflon-Wrapped Pipe Plugs. Certain pipe plugs have a thin strip of Teflon tape applied to the pipe threads before installation of the plug. This is done to provide better seal and also to permit easier removal of the pipe plug. Those pipe plugs requiring a Teflon wrapping are identified in the particular assembly procedure calling for the installation of such plugs. The method of Teflon wrapping these particular plugs is as follows:

(1) Be sure the pipe plug is thoroughly clean and dry before applying the Teflon tape. All dirt, grease, oil, and scale must be removed.

(2) Start the tape one or two threads from the small or leading edge of the plug, joining the tape together with an overlap of approximately 1/8 inch.

(3) Wrap the tape tightly in the same direction as you would turn a nut. Press the tape into the minor diameter of threads without cutting or ripping the tape.

(4) Torque the pipe plugs to their specified torque. Do not use power tools. Torque values of engine parts are provided in table 3-2.

Table 3-2. Torque Chart.

PART NAME OR LOCATION		LB-FT (N·m)
Main Bearing Capscrews		
Step 1 Tighten		140/150 (190/203)
Step 2 Advance to		300/310 (407/420)
Step 3 Loosen		All
Step 4 Tighten		140/150 (190/203)
Step 5 Advance		300/310 (407/420)
Connecting Rod Nuts		
Step 1 Tighten		70/75 (95/102)
Step 2 Advance to		*140/150 (190-203)
Step 3 Loosen all		Completely
Step 4 Tighten to		25/30 (34/41)
Step 5 Advance to		70/75 (95/102)
Step 6 Advance to		*140/150 (190/203)
*Torque 100 lb-ft (136 N·m) with lockplates.		
Vibration Damper Mounting Capscrews		55/65 (76/88)
Piston Cooling Nozzle Hexhead Capscrew		16/21 (22/28)
Front Cover		45/50 (61/68)
Rear Crankseal Housing		30/35 (41/47)
Front Support		55 (75)
Cylinder Head Capscrews		
Step 1		25 (34)
Step 2		80/100 (108/136)
Step 3		180/200 (244/271)
Step 4		280/300 (380/407)
Valve Crosshead Nuts with ST-669 Adapter		22/26 (30/35)
Fuel Fittings		11/13 (15/18)
Fuel Crossover Capscrews	NOTE:	34/38 Lb-Inch (3.8/4.3)
Rocker Lever Housing Capscrews		55/65 (75/88)
Valve Injector Adjusting Screw		
Locknuts with ST-669 Adapter		25/35 (34/47)
Rocker Lever Shaft Plugs		
Straight Plug		20/25 (27/34)
Taper Plug		20/30 (27/41)

Table 3-2. Torque Chart. (Continued)

PART NAME OR LOCATION		LB-FT (N•m)
Rocker Cover Capscrews		
Cork Gasket		12/17 (16/23)
Cork and Rubber Gasket		6/8 (8/11)
Cam Follower		30/35 (41/47)
Front Cover Capscrews		9/11 (12/15)
Spring Pack Capscrews		9/11 (12/15)
Fuel Filter		20/25 (27/34)
Brass Filter Fittings		30/40 (41/54)
Gear Pump Capscrews		11/13 (15/18)
Throttle Shaft Plug	NOTE:	40/55 Lb-Inch (4.5/6.2)
Filter Bracket Capscrews		20/30 (27/41)
Fuel Pump Mounting Capscrews		30/35 (41/47)
Cups		55 (75)
Orifice Plug	NOTE:	8/10 Lb-Inch (0.9/1.1)
Mounting Capscrews		10/12 (14/16)
Oil Pan and Adapter Capscrews		
5/16 In.		15/20 (20/27)
3/8 In.		28/40 (38/54)
Oil Pan Drain Plug		60/70 (81/95)
Oil Cooler Mounting Capscrew		30 (41)
Oil Pump Mounting Capscrews		35/45 (47/61)
Adjustable Water Pump Pulley		12/15 (16/20) (1/4-20 Capscrew)
Water Header Plates		8/10 (11/14)
Hose Clamps	NOTE:	30/35 Lb-Inch (3.4/4.0)
Water Pump Mounting		30/35 (41/47)

Table 3-2. Torque Chart. (Continued)

PART NAME OR LOCATION		LB-FT (N·m)
Water Manifold		30/35 (41/47)
Exhaust Manifold		
7/16 In. Capscrews with Washer		40 (54)
3/8 In. Studs		20/25 (27/34)
ST-50 Turbocharger		
Band	NOTE:	32/36 Lb-Inch (3.6/4.1)
Diffuser Plate		5/7 (7/9)
Air Crossover Hose Clamp	NOTE:	30/35 Lb-Inch (3.4/4.0)
Oil Drain Fitting		50 (68)
Oil Supply Fitting		20 (27)
Rotor Locknut		20/24 (27/33)
Mounting Locknut		22/28 (30/38)
Intake Manifold		20/25 (27/34)
Air Compressor		
Compact Head Capscrews		15/17 (20/23)
Connecting Rod Capscrews		15/17 (20/23)
Unloader Body Capscrews		8/10 (11/14)
Flywheel Capscrews		190/200 (258/271)
Flywheel Capscrews with Hardened Washers		200/220 (271/298)
Flywheel Housing Capscrews		90/100 (122/136)
Accessory Drive Pulley		90/100 (122/136)
Aftercooler		
Cover Capscrews		15/20(20/27)
Water Inlet & Outlet Flange Mounting Capscrews		27/32(37/43)

Section II. DISASSEMBLY OF THE ENGINE

3-6. Engine Disassembly. With the engine mounted securely in the engine maintenance stand, remove the following.

a. Vibration Damper and Pulley.

CAUTION

Do not pound on the damper with a hammer or pry with other tools when removing the vibration damper from the crankshaft.

The vibration damper and pulley combination is removed as an assembly by removing the capscrews securing the pulley and damper to the crankshaft (fig. 3-1). Pull it off the engine with both hands. Be careful that the damper does not fall to the ground. Refer to paragraph 3-177 for installation procedure and torque values.

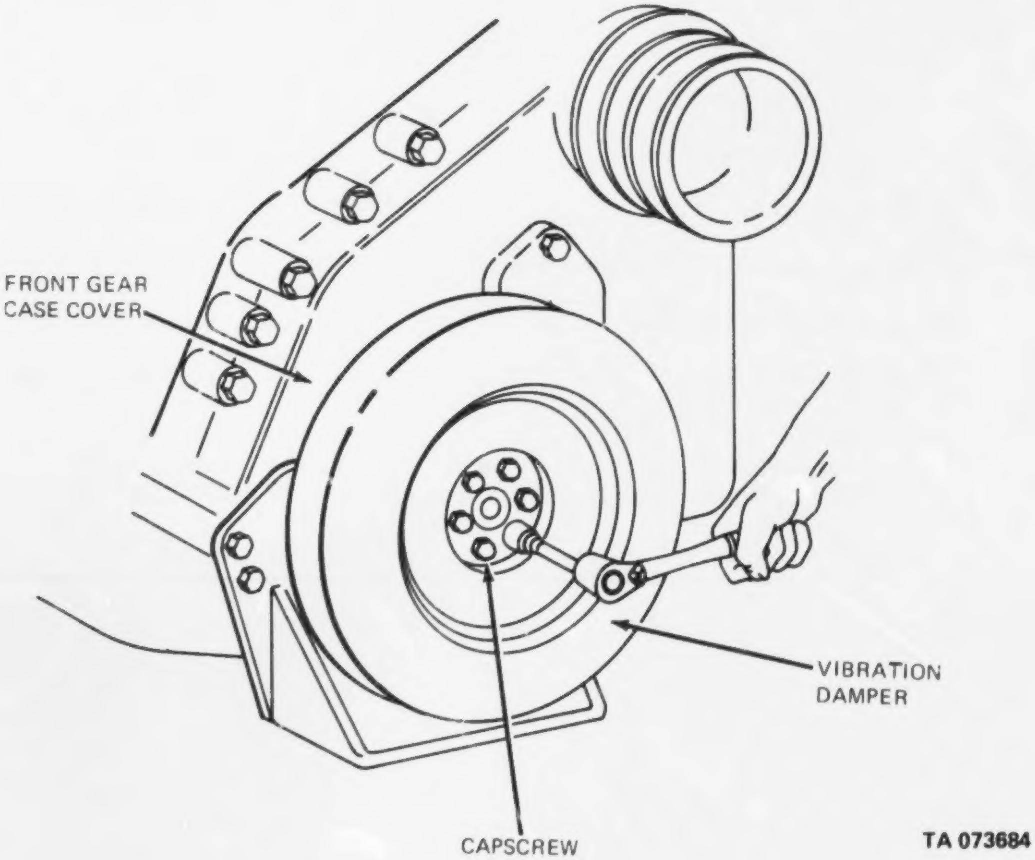


Figure 3-1. Removing and Installing the Vibration Damper.

b. Accessory Drive Pulley.

(1) Remove the locknut and washer.

NOTE

If the engine turns over when attempting to break the torque on the accessory drive pulley nut, insert two bolts in the end of the crank. Run a bar through the bolts and hold it to keep the engine from turning over when you break the nut loose.

CAUTION

Do not use jaw-type puller. Damage to pulley will result.

CAUTION

Do not insert bar puller capscrews all the way through the pulley. Do not let the capscrews bottom on the front gear cover. Damage to cover can result.

(2) Using a suitable T-bar puller, remove the accessary drive pulley (fig 3-2).

(3) Save the L-shaped keyway oil seal in the accessory drive pulley.

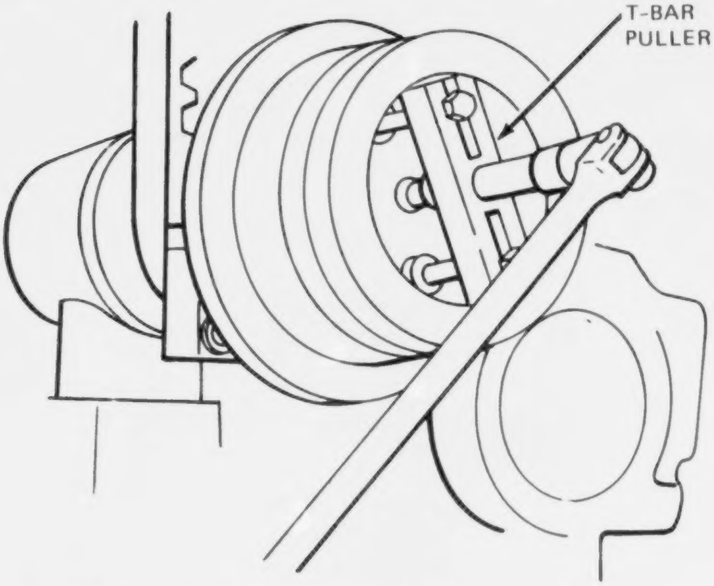


Figure 3-2. Removing the Accessory Drive Pulley.

c. Air Compressor and Fuel Pump.

CAUTION

Be careful when removing the air compressor and fuel pump. The combined unit is heavy.

(1) Disconnect the coolant inlet and outlet lines from the compressor and remove the lines from the engine (fig 3-3).

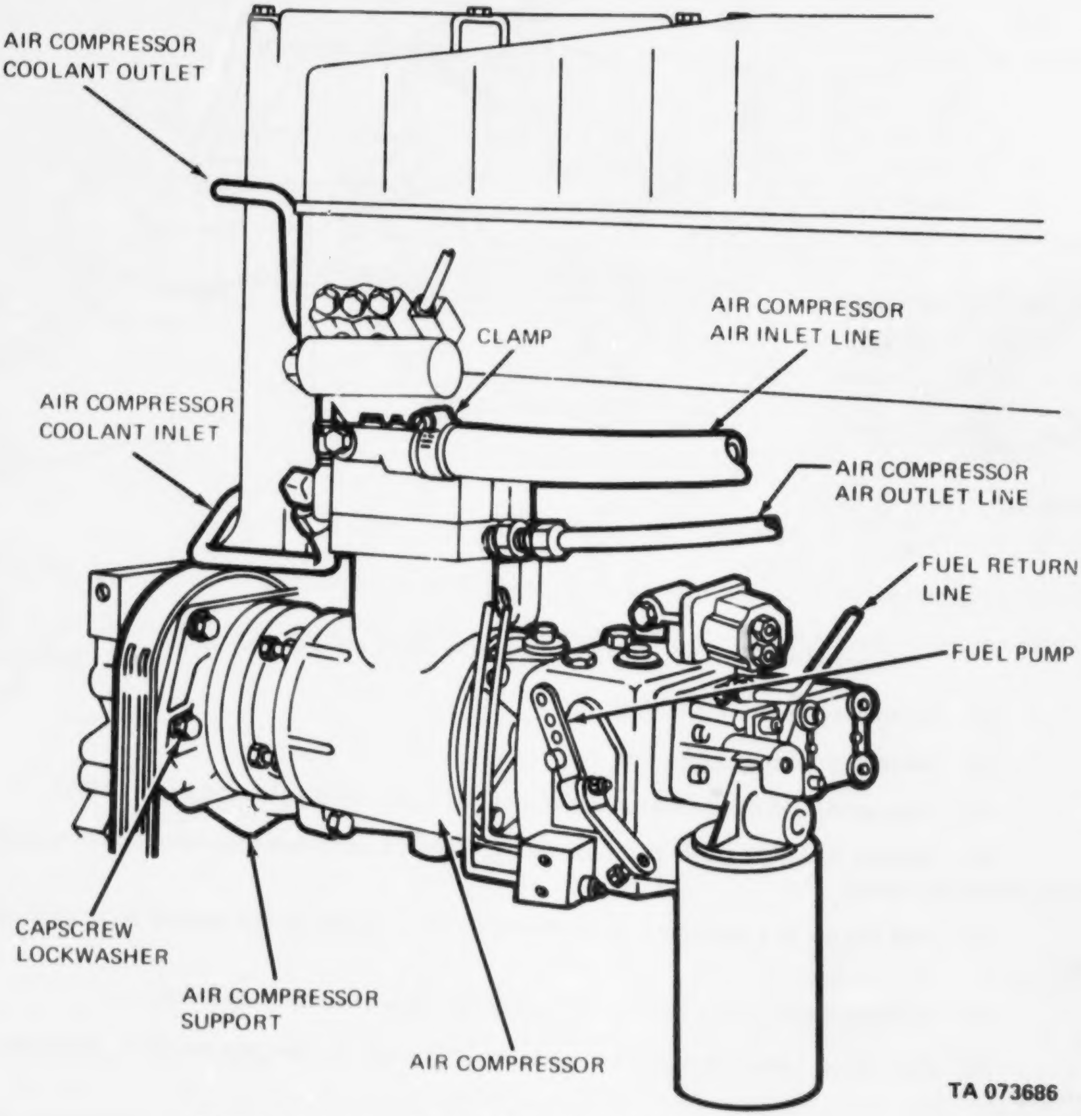

AIR COMPRESSOR COOLANT OUTLET
CLAMP
AIR COMPRESSOR AIR INLET LINE
AIR COMPRESSOR COOLANT INLET
AIR COMPRESSOR AIR OUTLET LINE
FUEL RETURN LINE
FUEL PUMP
CAPSCREW
LOCKWASHER
AIR COMPRESSOR SUPPORT
AIR COMPRESSOR
TA 073686

Figure 3-3. Removing and Installing the Air Compressor.

(2) Remove the three fuel return and supply lines from the fuel pump and cylinder head (fig. 3-4).

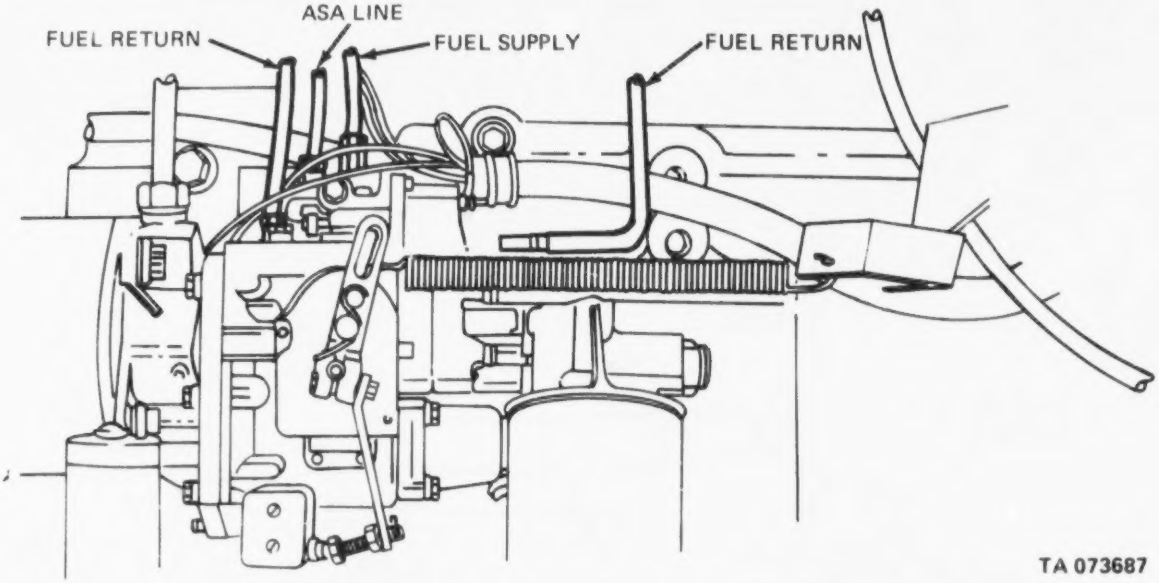


Figure 3-4. Removing and Installing Fuel Return and Supply Lines.

(3) Remove air governor and line.

(4) Remove air outlet supply line.

(5) Remove air line between aftercooler and fuel pump air supply attenuator (ASA).

(6) Remove fuel pump lever pull back spring. Remove capscrews and washers and remove spring mounting bracket.

(7) Remove the five capscrews and lockwashers securing the air compressor support to gear case.

(8) Remove the capscrew holding the fuel pump support bracket on block.

(9) Pull the air compressor and fuel pump straight back to disengage accessory drive gear from cam gear.

(10) Remove the capscrews and lockwashers securing the support to the air compressor and separate the support from the compressor. Tap with soft mallet if necessary. Remove the air compressor coupling.

(11) Remove and discard the gaskets.

(12) Remove the four 12-point mounting capscrews and remove the fuel pump and the fuel pump support bracket from the air compressor (fig. 3-5).

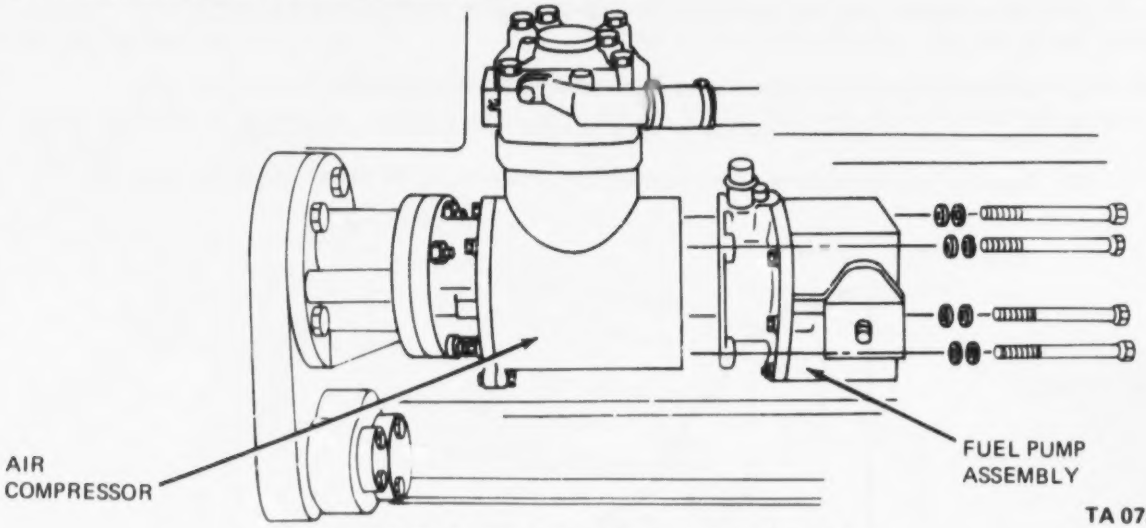

AIR COMPRESSOR
FUEL PUMP ASSEMBLY
TA 073688

Figure 3-5. Removing and Installing the Fuel Pump.

(13) Lift out the drive coupling from between the fuel pump and the air compressor.

(14) Cover the fuel pump connections to prevent dirt and other foreign matter from entering the fuel system.

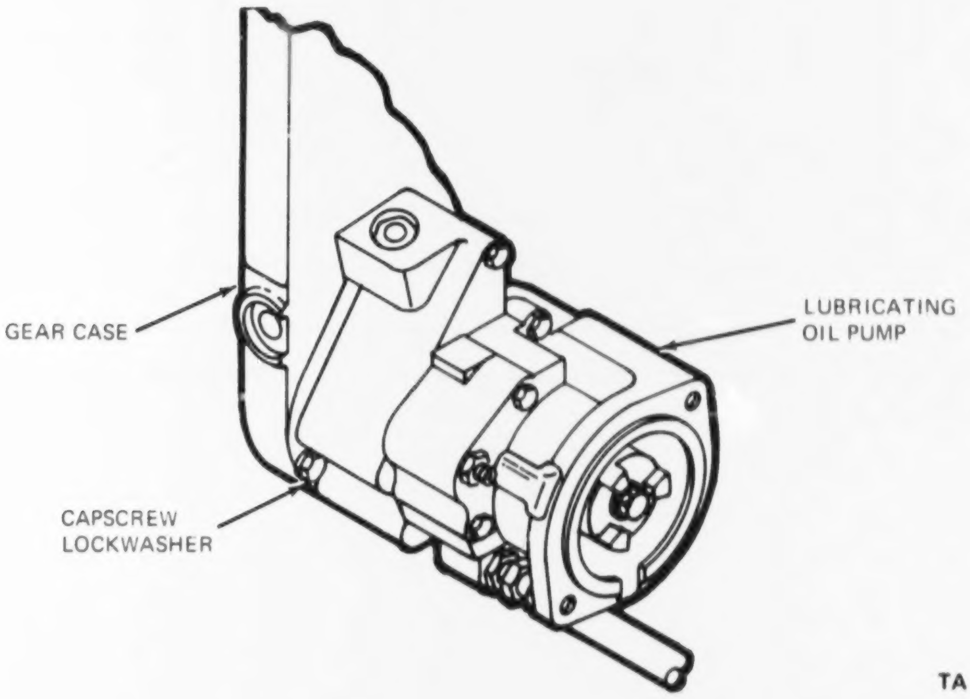
d. Oil Pump.

(1) Disconnect oil suction line at rear of oil pump, using an adjustable end wrench with a 2-1/2 inch jaw spread. Remove hose fitting from pump.

(2) Disconnect oil suction line clamp by removing oil pan capscrew.

(3) Disconnect oil suction line flange from oil pan. Remove oil suction line.

(4) Remove the five capscrews and lockwashers securing the oil pump to the gear case (fig. 3-6).



TA 073689

Figure 3-6. Removing and Installing the Lubricating Oil Pump.

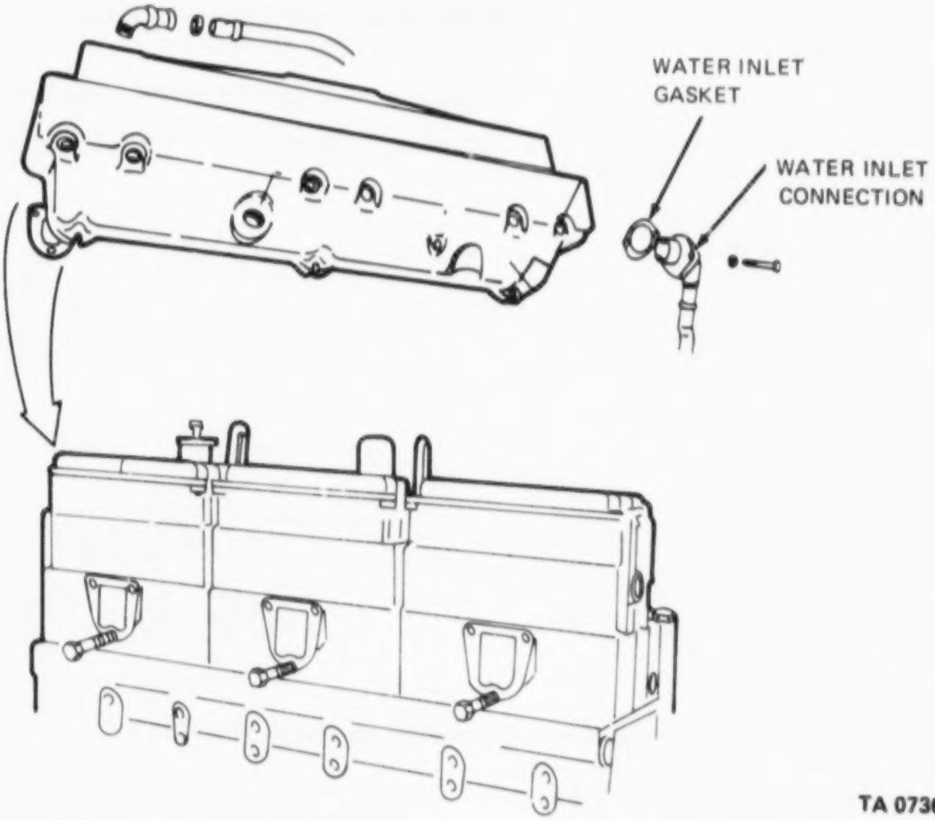
(5) Tap the oil pump with a soft-nosed mallet before pulling the oil pump off the front gear housing. Be careful when removing oil pump. Weight shifts as gears are exposed. Use both hands to prevent damage to gears.

(6) Remove and discard the gasket.

e. Intake Manifold and Aftercooler.

(1) Remove the water inlet connection to the aftercooler housing. Discard the inlet to housing gasket (fig. 3-7).

(2) Remove the remaining four upper capscrews, lockwashers, and washers securing the aftercooler assembly to the block. Loosen the bottom three capscrews. The bottom capscrews will support the weight of the aftercooler.



TA 073690

Figure 3-7. Removing the Intake Manifold and Aftercooler.

(3) Remove the aftercooler with attached turbocharger crossover by sliding it slightly upward to clear the bottom capscrews and pull it away from the engine. Discard the manifold-to-element gasket.

(4) Remove aftercooler inlet tube from block fitting.

f. Rocker Arm Housing Covers.

(1) Remove the capscrews and washers securing each cover.

(2) Remove the three covers.

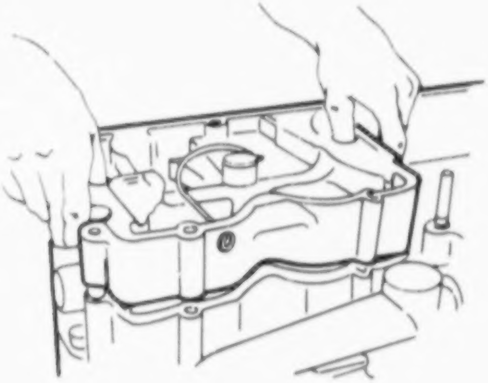
(3) Remove and discard gaskets.

g. Engine Retarder

(1) Bend down the locktabs on the nuts located on the inside of the housing. Remove the nuts and locktabs.

(2) Remove lifting eyes, spacers, all nuts, and lockwashers securing each section.

(3) Remove the three sections of the engine retarder by pulling straight up on the engine retarder to the rocker lever housing (fig 3-8).



TA 073691

Figure 3-8. Removing and Installing the Engine Retarder.

(4) Remove and discard gasket.

h. Rocker Lever Housing.

(1) Loosen the valve and injector adjusting screw locknuts one or two turns (fig. 3-9).

(2) Remove the studs and flatwashers securing each rocker housing to the cylinder heads (Reference appendix B for special tool. Engine Retarder Impact Socket 0112, part No. B-1465A.)

NOTE

Be careful not to let flatwashers slip off studs and fall down into engine.

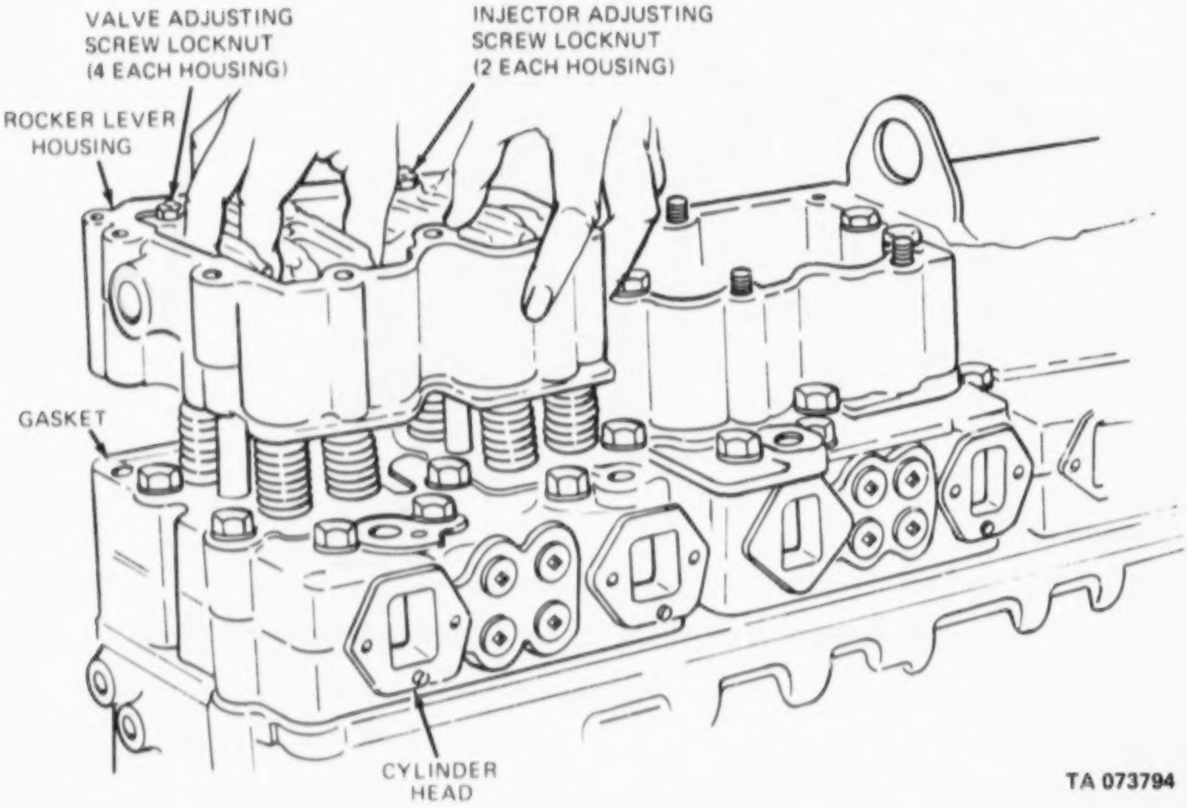

VALVE ADJUSTING SCREW LOCKNUT (4 EACH HOUSING)
INJECTOR ADJUSTING SCREW LOCKNUT (2 EACH HOUSING)
ROCKER LEVER HOUSING
GASKET
CYLINDER HEAD
TA 073794

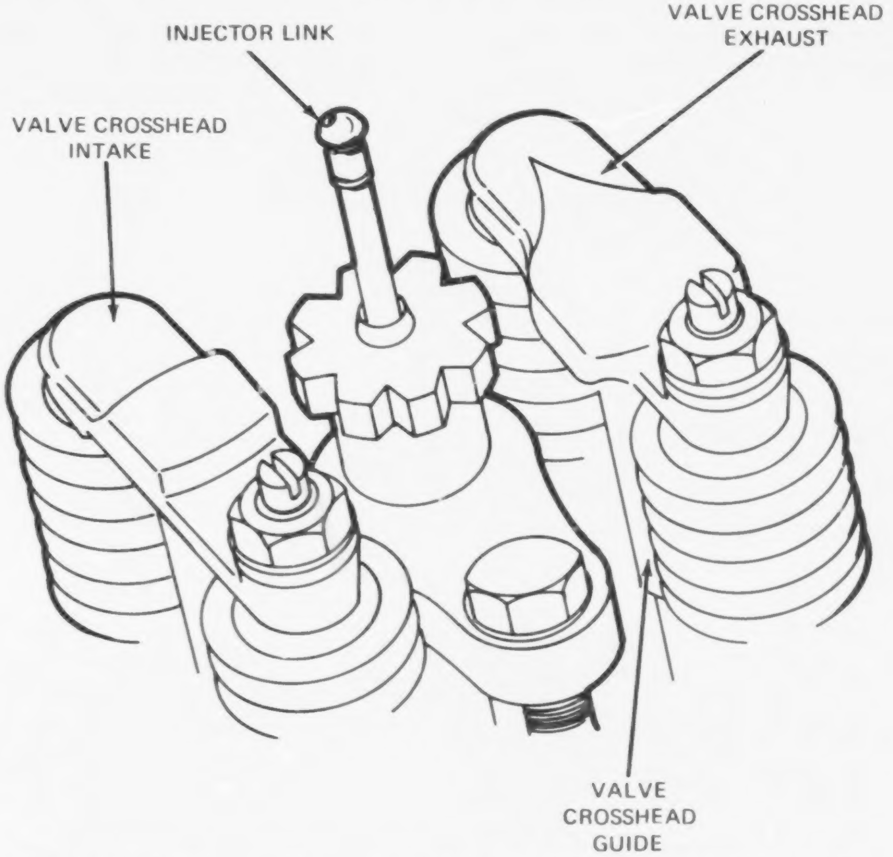
Figure 3-9. Removing and Installing the Rocker Lever Housing.

(3) Remove the rocker housings and discard gaskets.

i. Push Tubes. Lift all of the push tubes from the cam follower sockets.

j. Valve Crossheads. Lift and remove all of the crossheads from the cylinder heads (fig 3-10).

k. Injector Links. Lift and remove all injector links from the center of each injector.

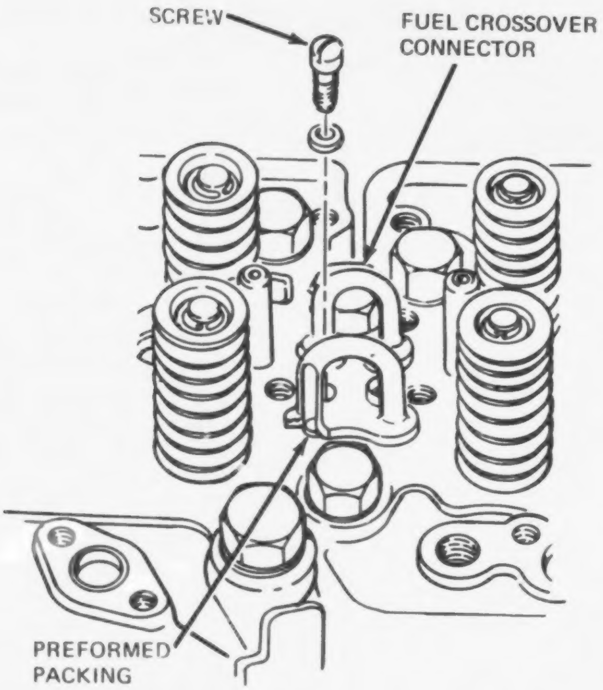

INJECTOR LINK
VALVE CROSSHEAD EXHAUST
VALVE CROSSHEAD INTAKE
VALVE CROSSHEAD GUIDE

TA 073692

Figure 3-10. Removing and Installing the Valve Crossheads and Injector Links

l. Fuel Crossover Connectors.

(1) Remove the slotted head screws securing the fuel crossover connectors to the cylinder heads (fig 3-11).


SCREW
FUEL CROSSOVER CONNECTOR
PREFORMED PACKING

TA 073693

Figure 3-11. Removing and Installing the Fuel Crossover Connectors.

(2) Lift off the crossover connectors and discard the preformed packings.

(3) Plug the fuel holes to prevent contamination.

m. Injectors.

CAUTION

Do not damage the injector tip. Be sure that the injectors and plungers are not intermixed.

(1) Remove the injector holddown capscrews and holddown clamp (fig 3-12).

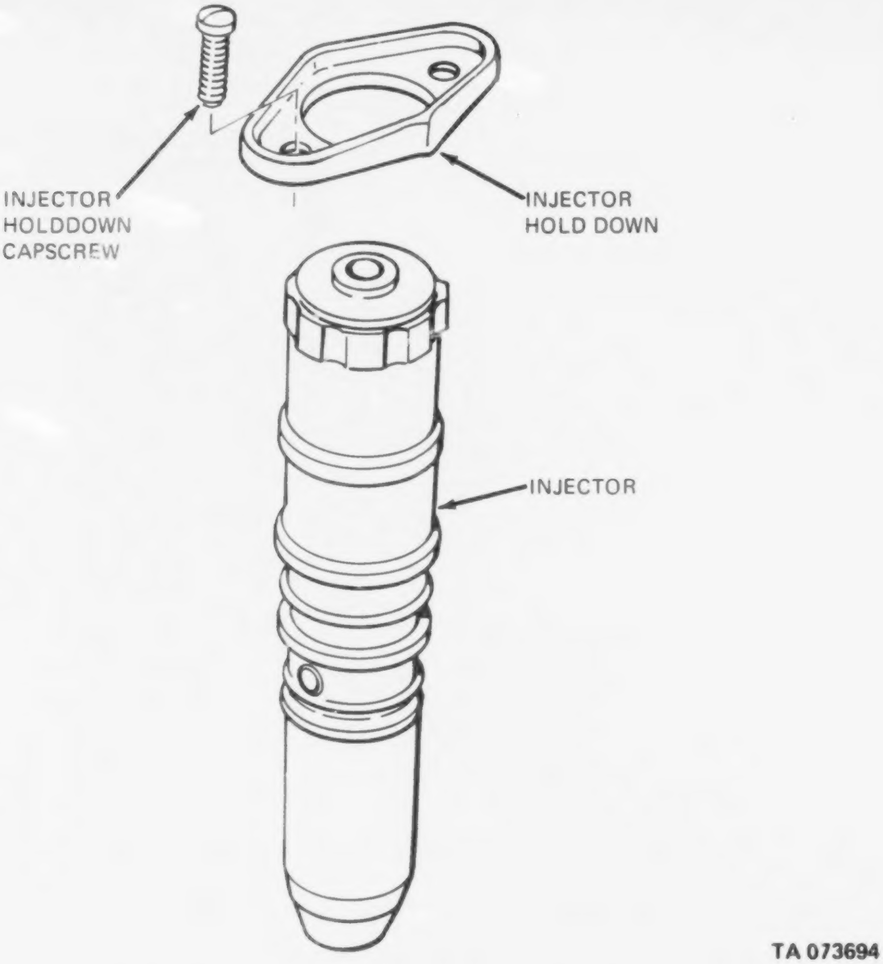

INJECTOR HOLDDOWN CAPSCREW
INJECTOR HOLD DOWN
INJECTOR
TA 073694

Figure 3-12. Removing and Installing the Fuel Injector.

(2) Using a suitable injector puller, remove the injectors from the head. Avoid dropping the injector plunger. Do not turn the injector upside down.

(3) If the same injectors are to be used, number the injectors according to the cylinder from which they were removed.

NOTE

Keep the injectors clean by wrapping each in clean cloth or paper.

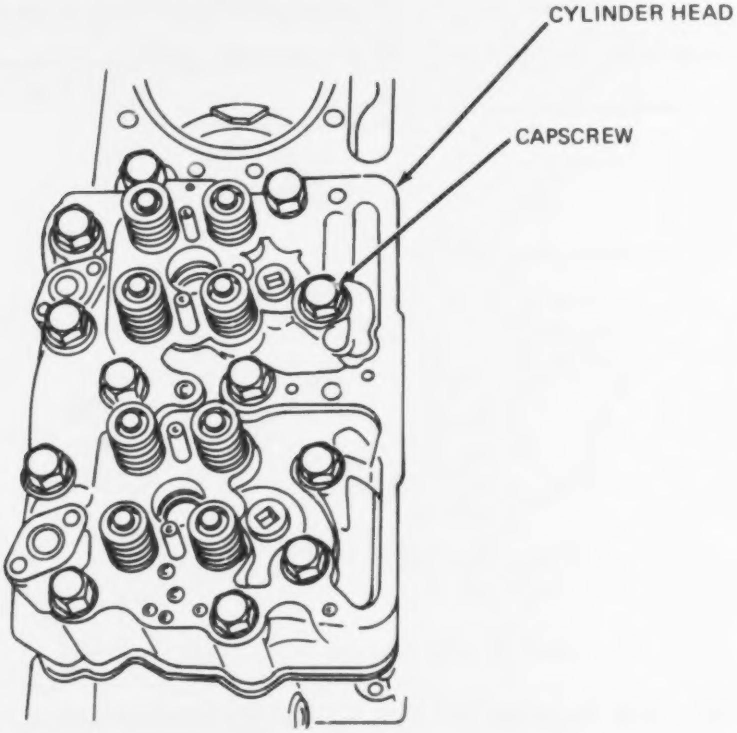
n. Cylinder Heads.

NOTE

Mark each head so it can be replaced in its original position on the block.

(1) Remove the capscrews securing each cylinder head to the cylinder block and lift each head from the block (fig 3-13).

(2) Remove and discard head gasket.



TA 073695

Figure 3-13. Removing and Installing the Cylinder Head.

o. Cam Follower Housing.

NOTE

Mark each cam follower housing so it will be replaced in its original position on the block.

(1) Remove the capscrews and lockwashers securing each cam follower housing to the cylinder block (fig 3-14).

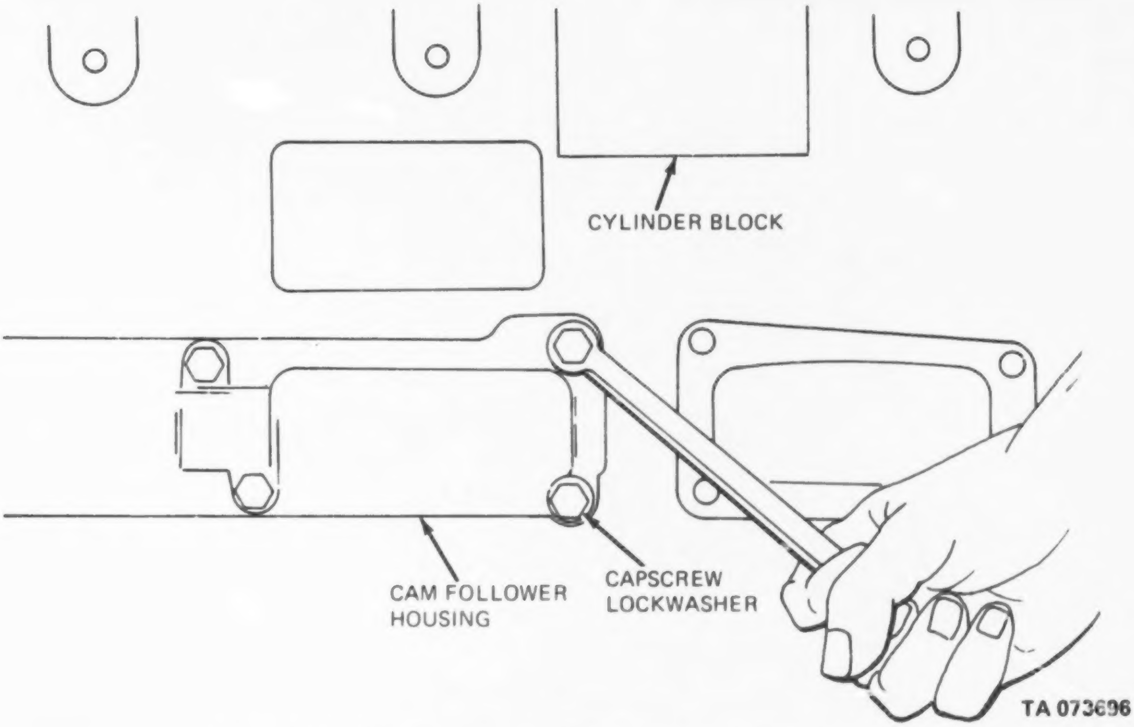


Figure 3-14. Removing and Installing the Cam Follower Housing.

(2) Carefully pry the housing from the dowels in block and remove the housing and cam follower assembly.

(3) Using a micrometer, measure and record the total thickness of the old gasket or gaskets for each cam follower housing before discarding the gaskets.

NOTE

Measuring the gasket or gaskets total thickness for each cam follower housing is required in spacing each cam follower housing for timing the injector. This is required due to individual differences between castings.

p. Flywheel.

(1) Remove two opposite capscrews securing the flywheel to the crankshaft.

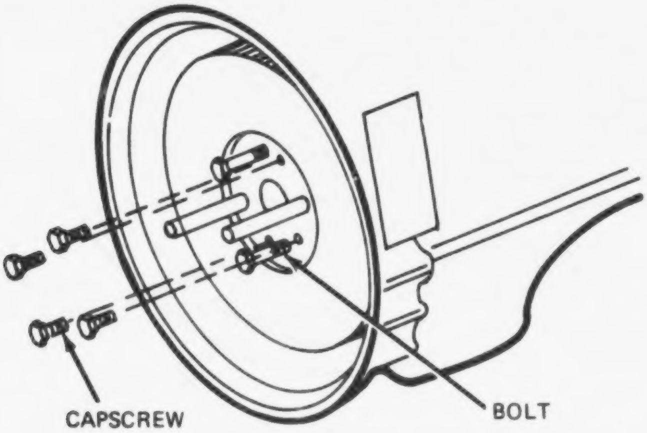
(2) Insert two 5/8-18 x 6 inch studs in two opposite holes in the flywheel. Screw the studs into the crankshaft flange.

NOTE

These studs will provide support for
the flywheel during removal.

(3) Remove the remaining four capscrews securing the flywheel.

(4) In two holes provided, place two 1/2-13 x 6 inch bolts, threaded their entire length, to act as jackscrews (fig. 3-15).



TA 073697

Figure 3-15. Removing the Flywheel.

(5) Turn in the jackscrews alternately to pull the flywheel from the crankshaft.

(6) Remove 5/8-18 inch studs from crankshaft flange and 1/2-13 inch capscrews from flywheel.

q. Flywheel Housing.

(1) Remove the four capscrews, two bolts, flatwashers, and lockwashers securing the oil pan to the flywheel housing at each side of the oil pan (fig 3-16).

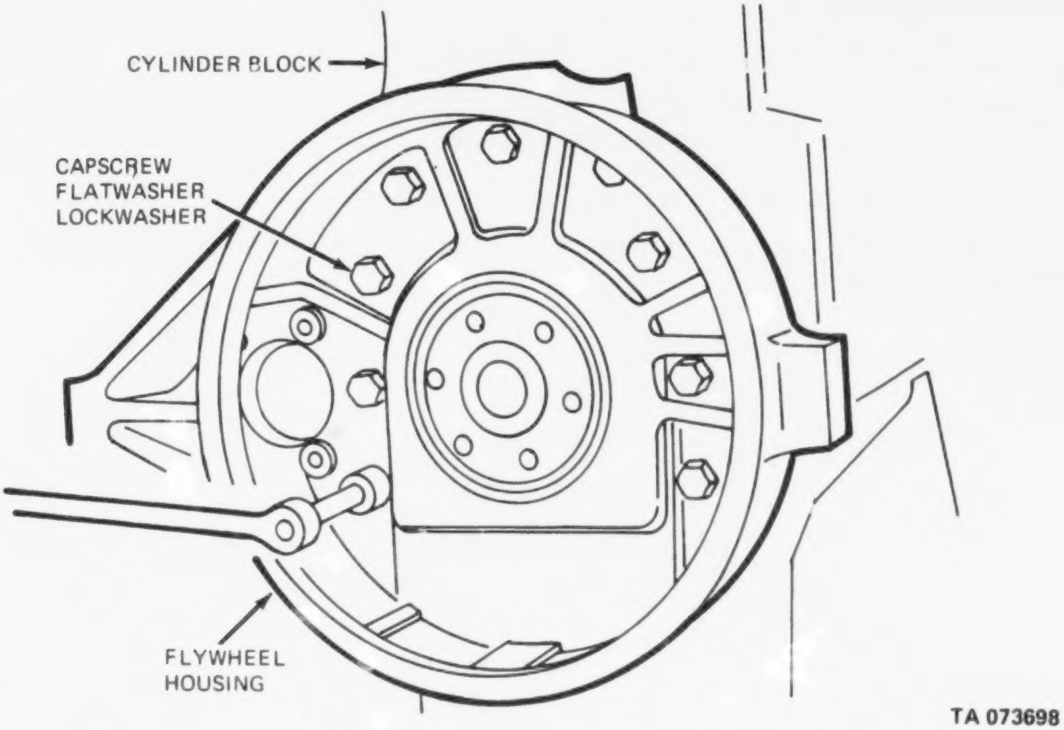

CYLINDER BLOCK
CAPSCREW
FLATWASHER
LOCKWASHER
FLYWHEEL
HOUSING
TA 073698

Figure 3-16. Removing and Installing the Flywheel Housing.

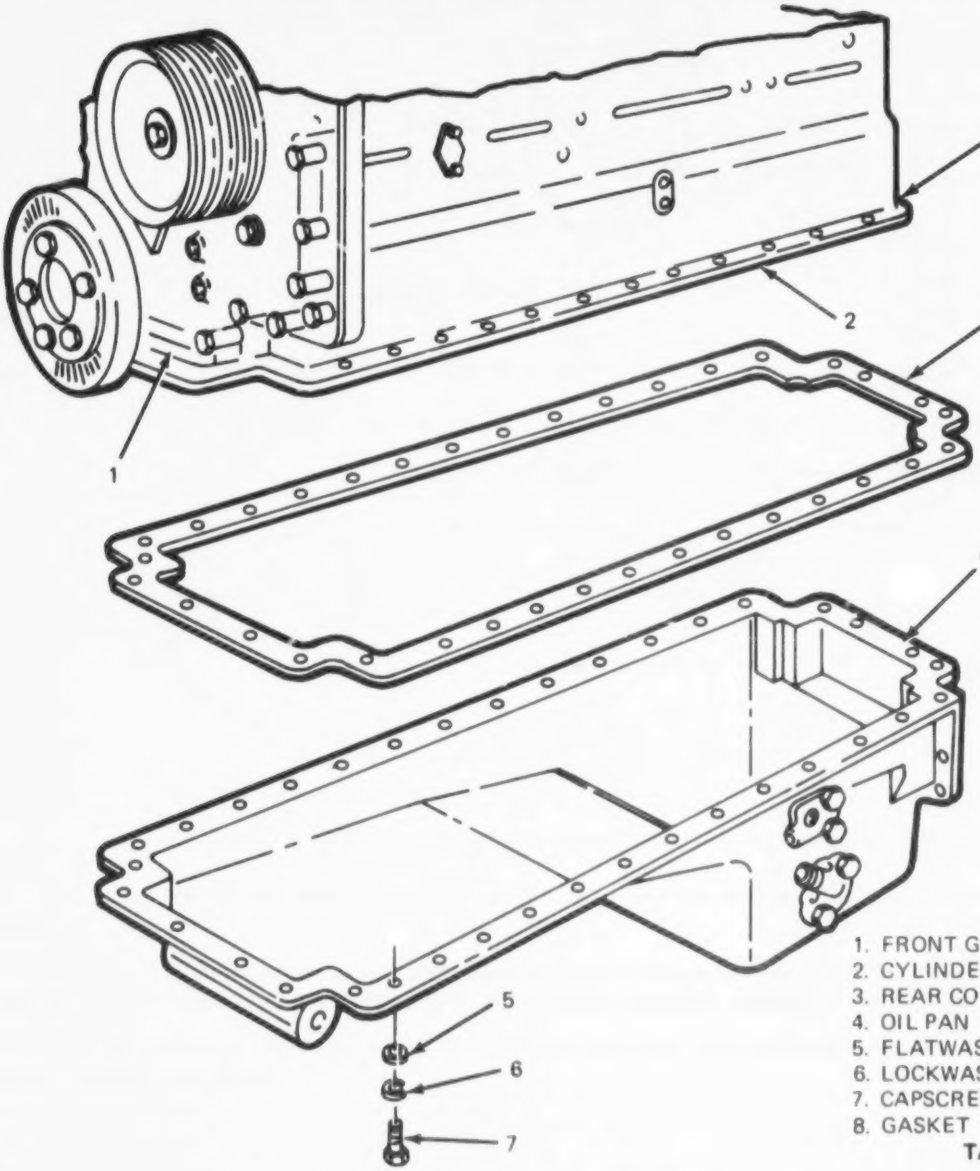
(2) Remove the capscrews, flatwashers, and lockwashers securing the flywheel housing to the cylinder block.

(3) Drive the flywheel housing from the two dowels with a block of wood or a soft-nosed hammer and remove.

(4) Remove and discard the preformed packing from rear cover.

r. Oil Pan.

(1) Remove the capscrews (7), flatwashers (5), and lockwashers (6) securing the oil pan (4) to the cylinder block (2), front gear case cover (1) and rear cover (3) (fig. 3-17).



1. FRONT GEAR CASE COVER
2. CYLINDER BLOCK
3. REAR COVER
4. OIL PAN
5. FLATWASHER
6. LOCKWASHER
7. CAPSCREW
8. GASKET

TA 073795

Figure 3-17. Removing and Installing the Oil Pan.

(2) Remove the oil pan (4) and discard the oil pan gasket.

s. Rear Cover and Oil Seal.

(1) Remove the capscrews, flatwashers, and lockwashers securing the rear cover to the cylinder block (fig. 3-18).

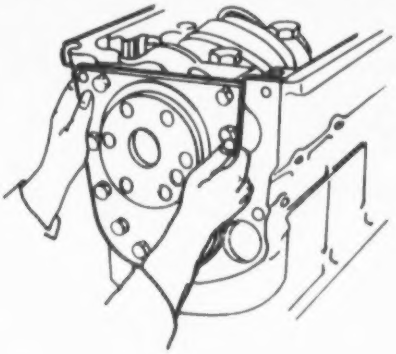

TA 073699

Figure 3-18. Removing and Installing the Rear Cover and Oil Seal.

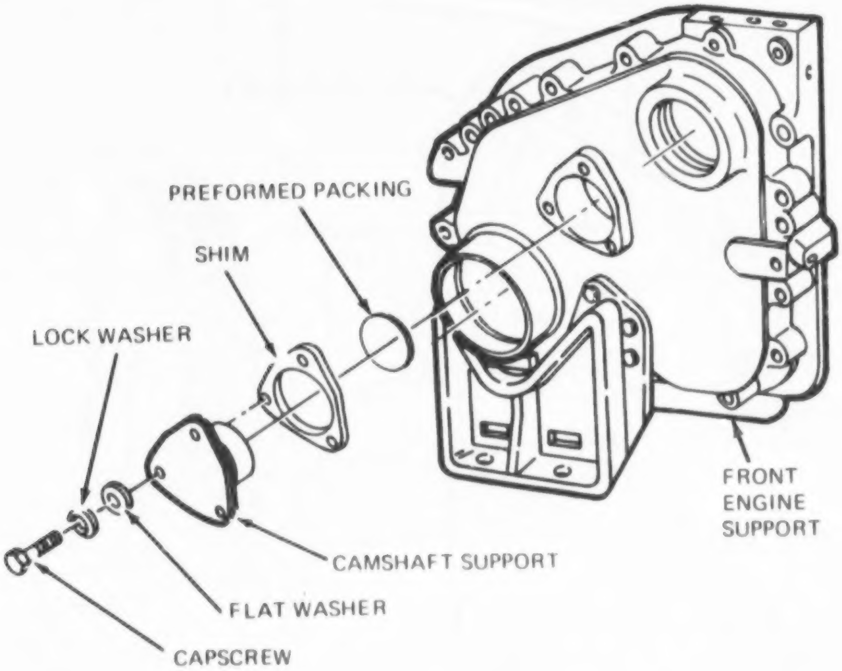
(2) Remove the cover and seal from the crankshaft flange.

(3) Remove and discard the rear cover gasket.

t. Front Gear Case Cover.

(1) Remove front engine support.

(2) Remove the capscrew, flatwashers, and lockwashers securing the front gear case cover to the cylinder block (fig 3-19).


PREFORMED PACKING
SHIM
LOCK WASHER
FRONT ENGINE SUPPORT
CAMSHAFT SUPPORT
FLAT WASHER
CAPSCREW

TA 073700

Figure 3-19. Removing and Installing the Front Gear Case Cover.

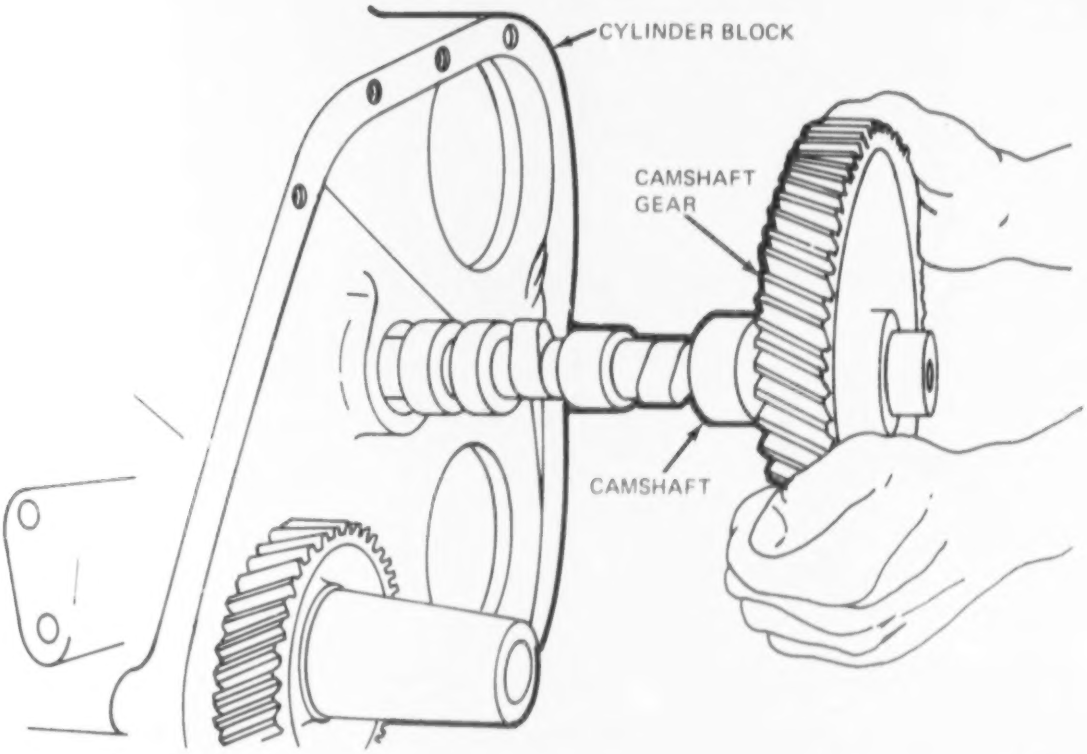
(3) Install two guide studs, four inches long, into the capscrew holes, one on each side of the cover.

(4) Remove three capscrews, flatwashers and lockwashers securing the front camshaft support to the front gear case cover (fig. 3-19). Remove the camshaft support, shim and preformed packing.

(5) Using a soft hammer, loosen the gear case cover and gasket and remove from the cylinder block. Discard the gasket.

u. Camshaft and Gear.

Rotate the camshaft gears lightly while pulling the camshaft from the cylinder block (fig 3-20). Remove camshaft.


CYLINDER BLOCK
CAMSHAFT GEAR
CAMSHAFT

TA 073701

Figure 3-20. Removing and Installing the Camshaft.

CAUTION

Use extreme caution when removing the camshaft to avoid damaging the bushings.

v. Connecting Rod and Piston Assemblies.

(1) Position the cylinder block in a vertical position with the rear of the block down. Clean all of the carbon from the upper inside wall of each cylinder liner with a ridge reamer and fine emery cloth so the rings will not snap or chip when the piston is removed.

(2) Remove the connecting rod capscrews securing the connecting rod caps (fig 3-21).

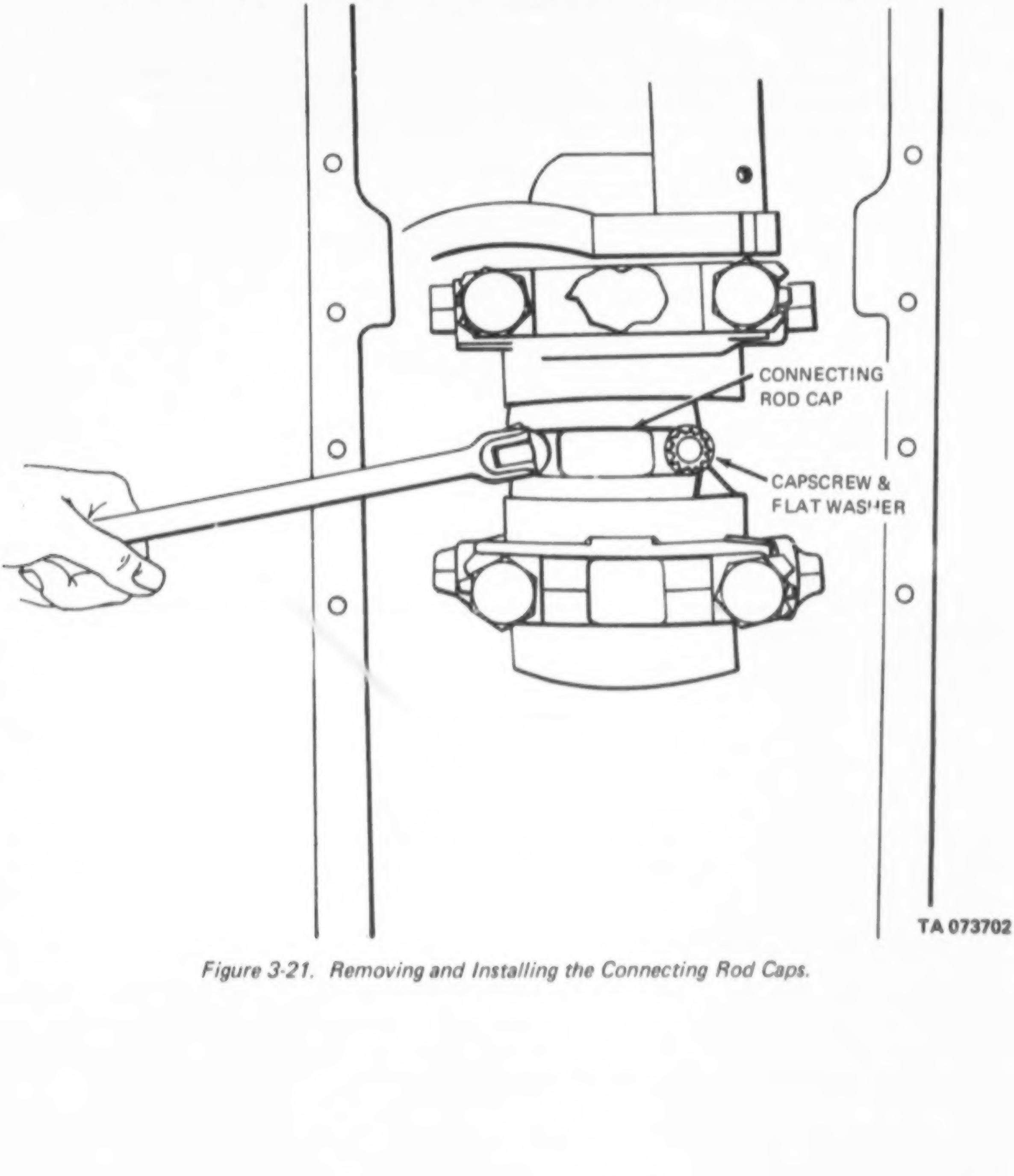

CONNECTING ROD CAP
CAPSCREW & FLAT WASHER
TA 073702

Figure 3-21. Removing and Installing the Connecting Rod Caps.

(3) Remove the connecting rod caps and the lower bearing shells from the connecting rod caps.

CAUTION

Do not mutilate or score the inner walls of the cylinder liner.

(4) Push the connecting rod and piston assemblies from the cylinder liner bores using a wooden stick, holding the pistons so they will not be dropped or damaged. Remove and discard the piston rings. Remove the upper connecting rod bearing shell from the connecting rod.

NOTE

Check each connecting rod and cap as removed to make sure it is marked or stamped to prevent mixing. If a new connecting rod assembly is used, be sure to stamp it before installing it in the engine. The stamped number always appears on the camshaft side of the connecting rod.

(5) Reassemble each connecting rod cap to the rod as it is removed.

NOTE

The connecting rod caps are not interchangeable.

(6) Tape the mating connecting rod bearing shells together and label each pair by cylinder number for later reference.

(7) Remove the piston pin snaprings.

CAUTION

Do not drive or use excessive force when removing the pin from the piston.

(8) Remove the piston pins.

(a) Heat the pistons in boiling water to facilitate removal of the piston pins.

(b) Push the piston pin from the piston with a suitable wood or plastic drift.

(9) Tag all pistons to facilitate the replacement in original cylinders upon reassembly.

w. Cylinder Liners.

(1) Using a suitable cylinder liner puller and puller plate, remove the cylinder liners from the cylinder block (fig 3-22).

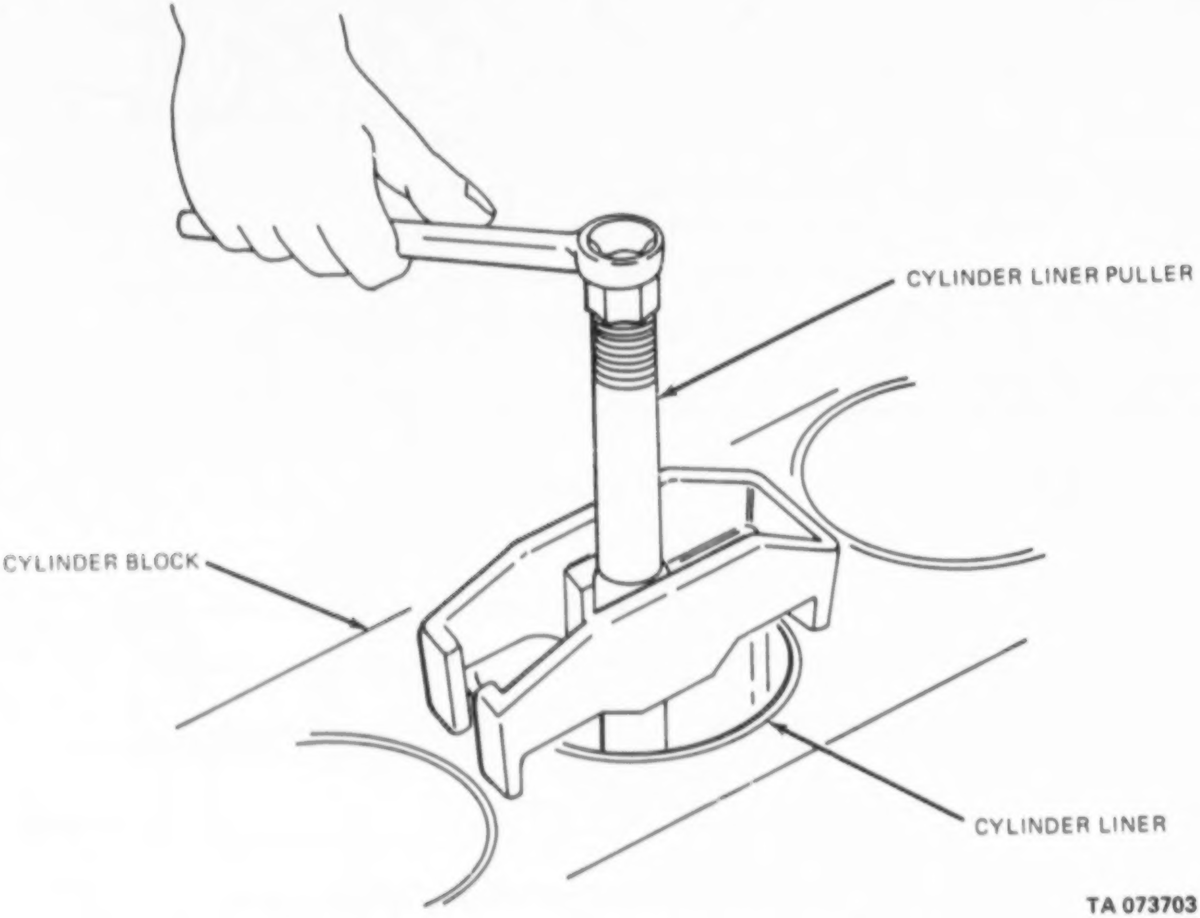

CYLINDER LINER PULLER
CYLINDER BLOCK
CYLINDER LINER
TA 073703

Figure 3-22. Removing the Cylinder Liner from the Cylinder Block

(2) Remove and discard the seals.

x. Crankshaft and Main Bearings.

(1) Turn the engine upside down.

(2) Bend down the lockplates and remove the two capscrews from the bearing cap (fig 3-23).

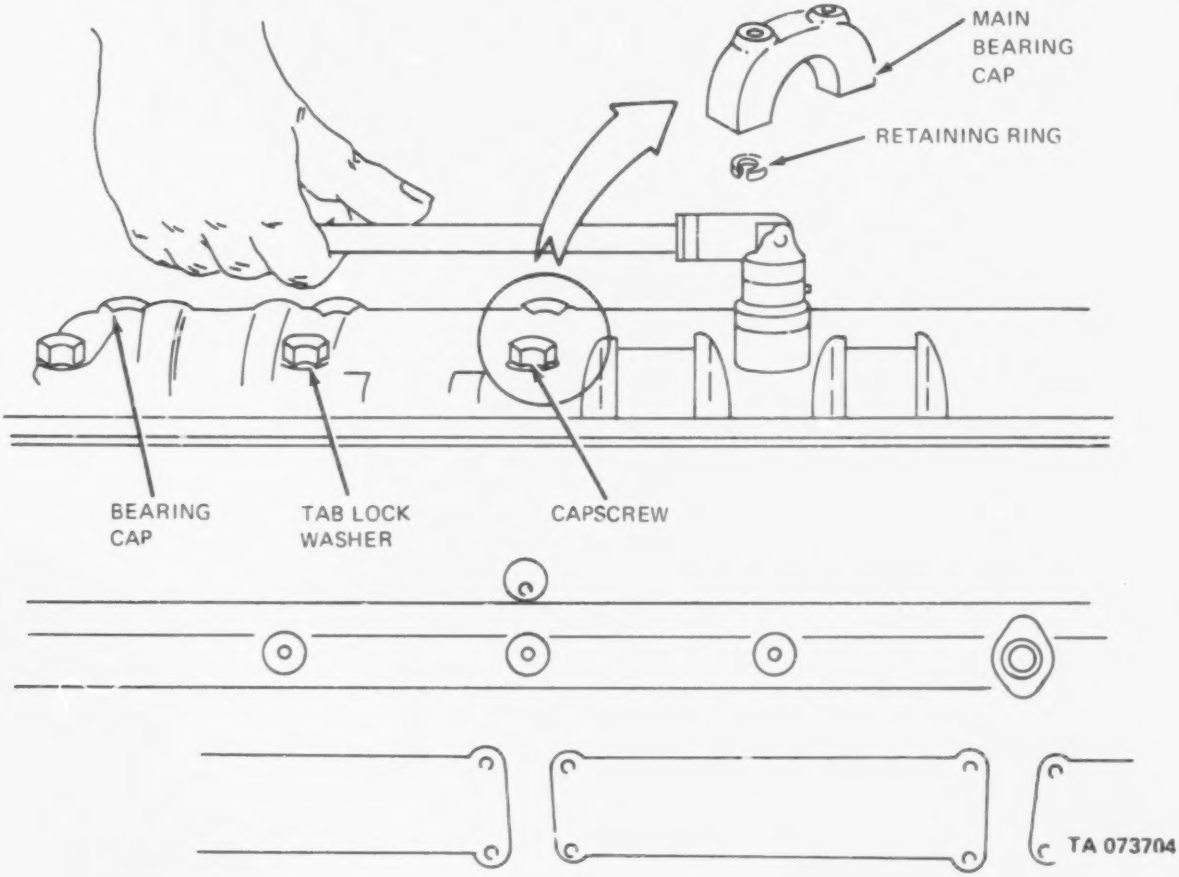

MAIN BEARING CAP
RETAINING RING
BEARING CAP
TAB LOCK WASHER
CAPSCREW
TA 073704

Figure 3-23. Removing and Installing the Main Bearing Cap Capscrews.

(3) Using a small pry bar, loosen each bearing cap (fig. 3-23). Lift the caps and rear thrust rings from the block. Mark the caps with their respective block position.

(4) Remove the bearing halves and the bearing retaining rings from the bearing caps.

NOTE

In some cases, the bearing retaining rings may be in the counterbore of the block after the cap has been removed.

(5) Using rubber protected hooks or rope on two crank throws, lift the crankshaft from the cylinder block (fig 3-24).

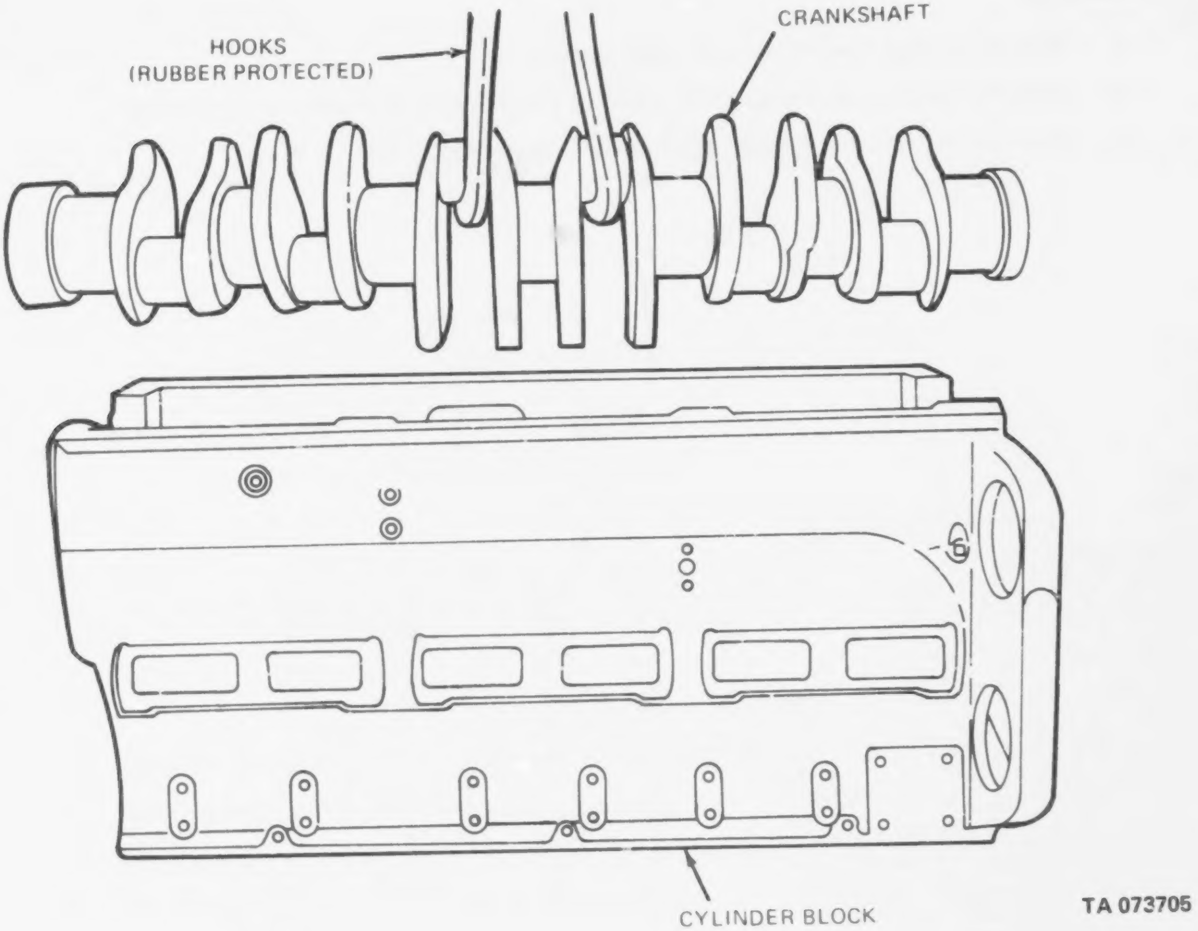

HOOKS
(RUBBER PROTECTED)
CRANKSHAFT
CYLINDER BLOCK
TA 073705

Figure 3-24. Removing and Installing the Crankshaft.

(6) Remove all upper bearing halves and thrust rings from the block. Tape the mating bearing halves together and label each pair by journal number for later reference.

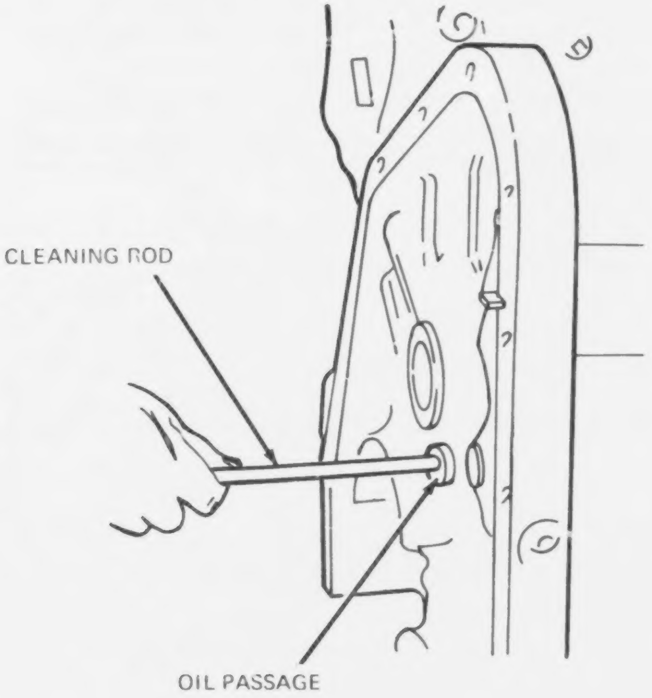
Section III. REPAIR OF CYLINDER BLOCK

3-7. Cleaning.

a. Remove all plugs from the oil and water passages.

b. Clean the block by submerging it in a tank of cleaning solution heated to near boiling.

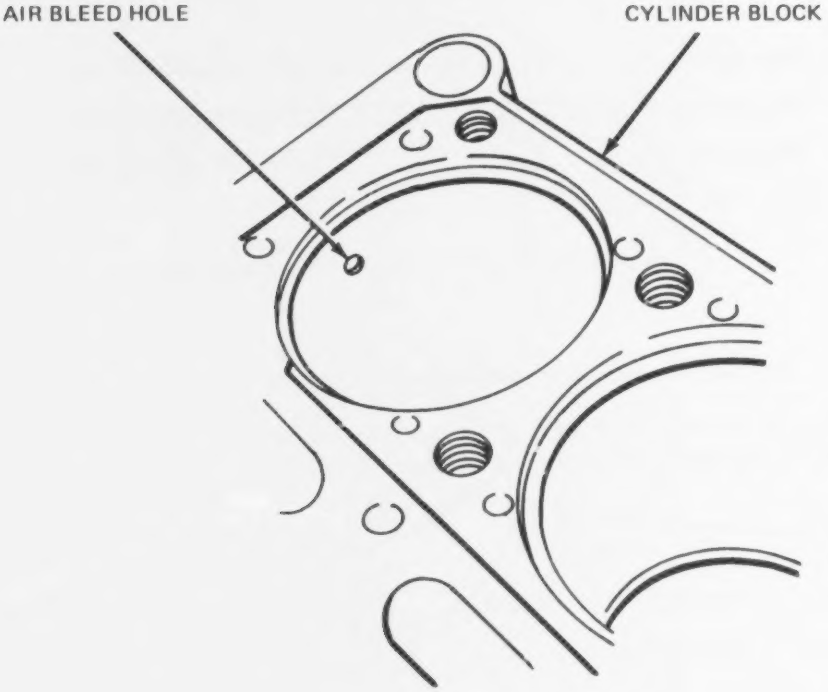
c. Run rods with brushes through all of the oil passages (fig 3-25).



TA 073706

Figure 3-25. Cleaning Blocked Oil Passages.

d. Clean the water pump cavity vent hole in number one cylinder (fig 3-26).



TA 073707

Figure 3-26. Air Bleed Hole Location.

e. Air blow all dirt and cleaning solvent from the capscrew holes.

f. Remove the scale from the liner bore counterbore.

g. Clean the lower liner bore with sandpaper or a sanding drum.

h. Refer to para 3-2 for additional cleaning instructions.

3-8. Inspection.

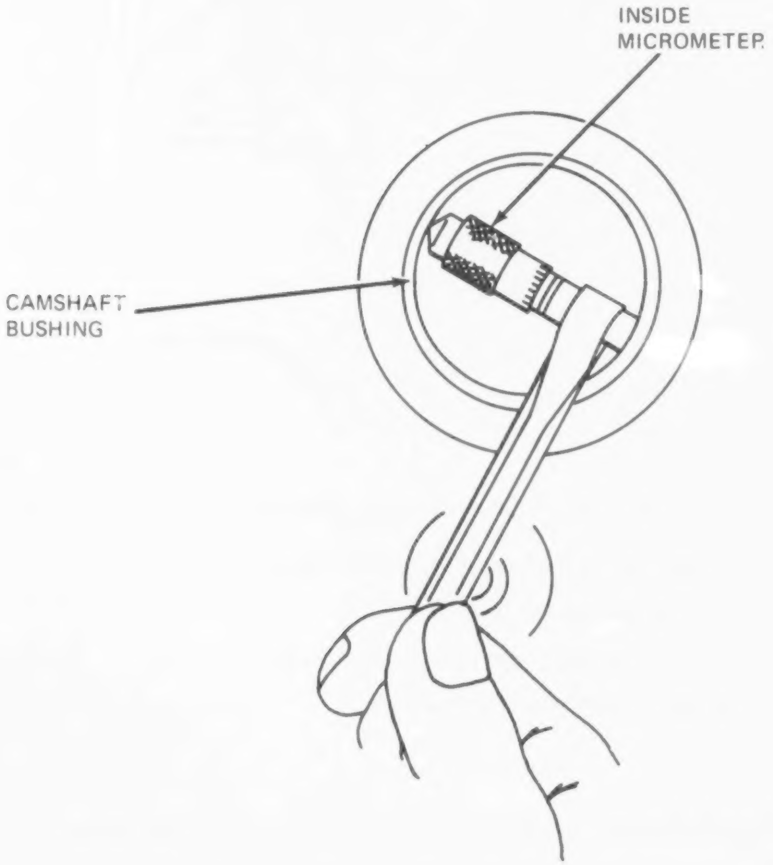
a. Inspect the wearing surfaces and general overall condition of the cylinder block.

b. Check the cylinder block for corrosion, pitting, and distortion.

c. Inspect the camshaft bushings according to the following method.

(1) Check the camshaft bushings using an inside micrometer or a dial bore gage (fig 3-27). Mark the bushings for replacement if they are worn more than the limit shown in the following specifications:

(a) New Minimum .... 2.4983 inch (63.457 mm)
(b) New Maximum .... 2.5008 inch (63.520 mm)
(c) Wear Limit .... 2.5018 inch (63.546 mm)



TA 073708

Figure 3-27. Checking Camshaft Bushing Inside Diameter.

(2) Mark bushings for replacement if chipped, scored, or scratched.

(3) If the bushings have turned in block bore, check the block bore size. Refer to the following bushing bore specifications:

(a) New Minimum .... 2.6245 inch (66.662 mm)
(b) New Maximum .... 2.6255 inch (66.688 mm)

(4) Be certain the oil passages between the camshaft bushings and the block oil holes are correctly alined.

d. Inspect the cylinder liner counterbore for burrs, dirt, and distortion. The counterbore ledge (1) must be smooth and perpendicular to the cylinder liner bore (2) (fig 3-28).

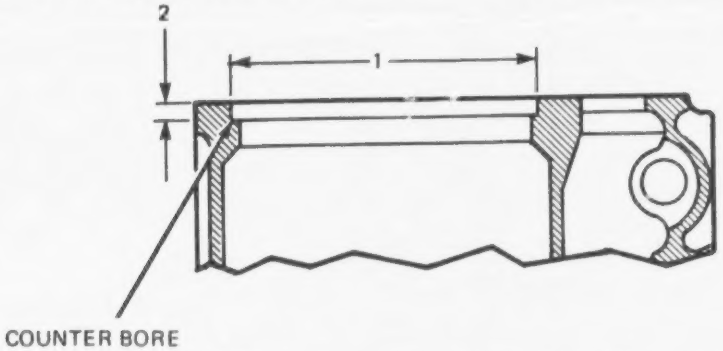


Figure 3-28. Cylinder Liner Counterbore Measurement Points.

e. Check the liner counterbore diameter and depth (fig. 3-28) to ensure proper seating of the cylinder liner and to determine if refinishing of the counterbore surface is necessary. Refer to the following dimensions:

	Diameter	Depth
(1) New Minimum	6.5615 in. (166.66 mm)	0.350 in. (8.89 mm)
(2) New Maximum	6.5635 in. (166.71 mm)	0.352 in. (8.94 mm)
(3) Wear Limits	—	0.413 in. (10.49 mm)

NOTE

Cylinder liner counterbore shims are available for counterbore depth wear.

f. Check for the correct cylinder liner protrusion. Cylinder liner must protrude 0.003-0.006 inch (0.08-0.15 mm) above the block. Use the following procedure to check for proper protrusion without installing a cylinder liner.

(1) Measure the liner flange outside bead with a micrometer (fig 3-29).

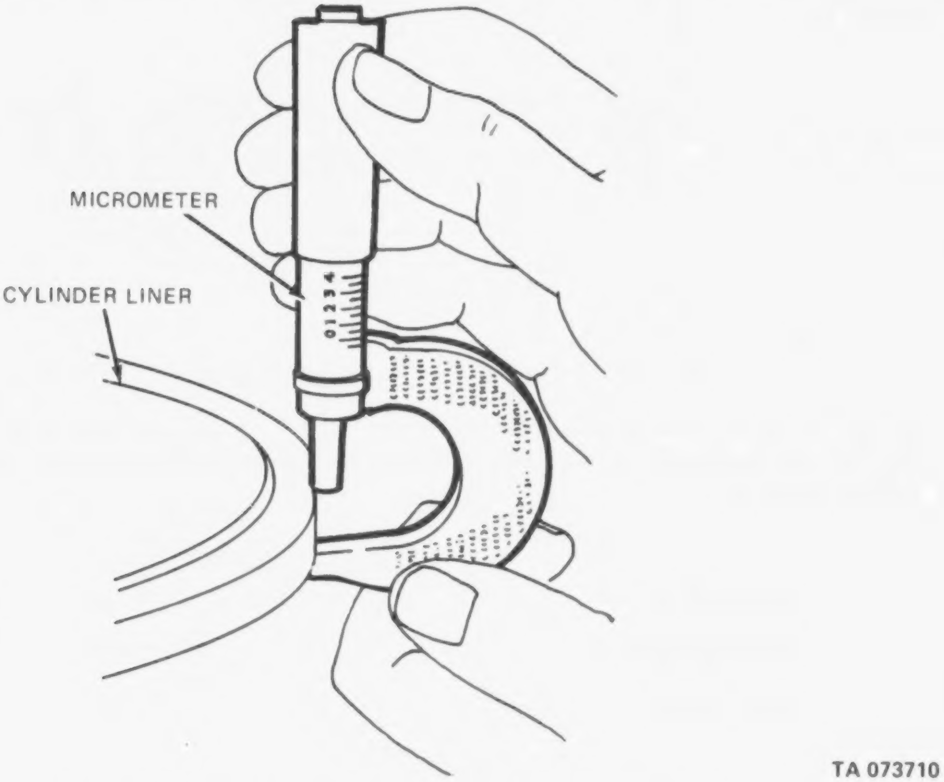
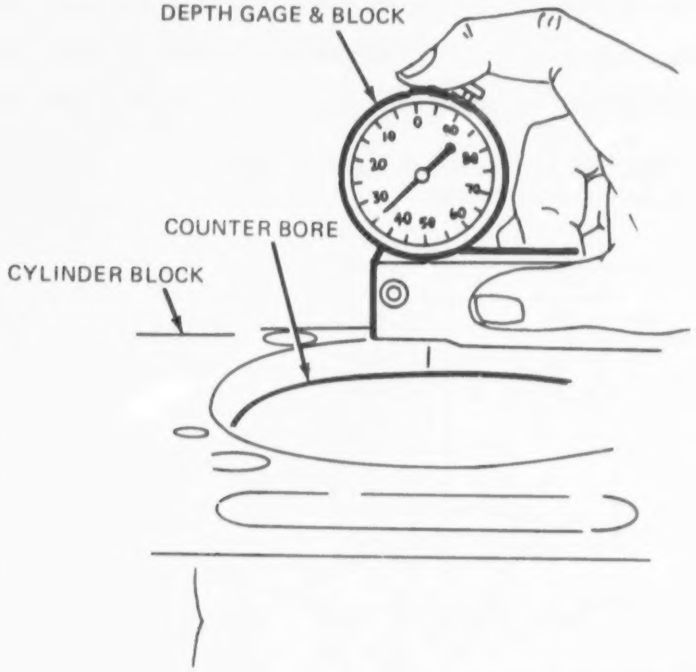

MICROMETER
CYLINDER LINER
0 1 2 3 4
TA 073710

Figure 3-29. Checking Liner Flange Height at Outside Bead.

NOTE

Do not include bead on top of liner flange when taking measurement.

(2) Measure the block counterbore depth with gage block (fig 3-30).


DEPTH GAGE & BLOCK
COUNTER BORE
CYLINDER BLOCK
0
10
20
30
40
50
60
70
80
90

TA 073711

Figure 3-30. Checking Counterbore Depth.

(3) Check the depth at four equidistant locations. The ledge must not be "cupped" more than 0.0014 inch (.0356 mm). Depth must not vary more than 0.001 inch (.0254 mm).

(4) Subtract the counterbore depth from the liner flange thickness to determine the amount of shims and/or depth of counterbore cut that must be used to provide 0.004-0.006 inch (.102-.152 mm) liner protrusion. Thinnest shims available are 0.007 inch (0.187 mm).

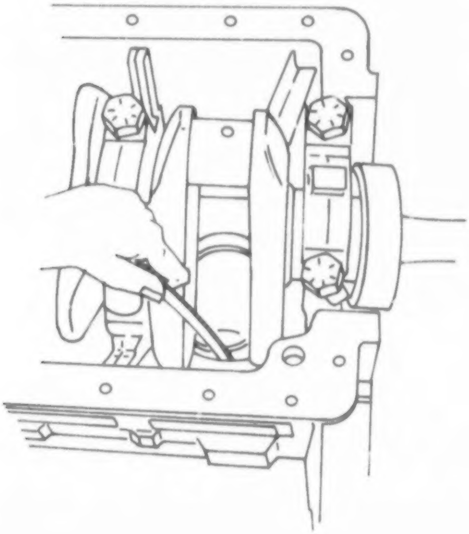
g. Check the clearance between the cylinder block and liner as shown in figure 3-31. The following specifications give liner to block clearance:

(1) Minimum .... 0.002 inch (0.05 mm)

(2) Maximum .... 0.006 inch (0.15 mm)

NOTE

This check is made without packing rings or service seals installed.



TA 073712

Figure 3-31. Checking Clearance Between Block and Liner.

NOTE

If clearance is not correct, check the lower block packing ring bore inside diameter.

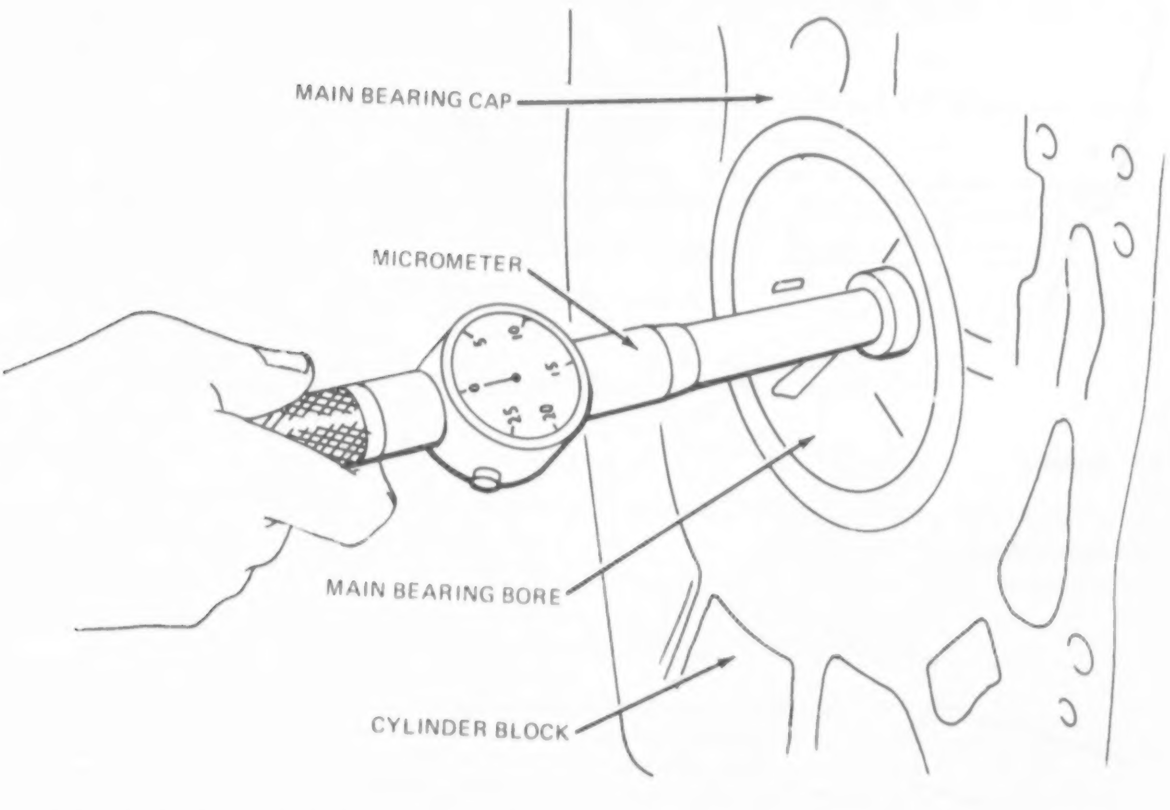
h. Check the lower liner bore inside diameter according to the following specifications:

(1) Minimum .... 6.124 inch (155.55 mm)

(2) Maximum .... 6.126 inch (155.60 mm)

i. Inspect the main bearing bores horizontally, vertically, and diagonally using a dial bore gage or inside micrometer (fig 3-32). Refer to the following dimensions:

(1)	New Minimum	4.7485 inch (120.612 mm)
(2)	New Maximum	4.750 inch (120.650 mm)
(3)	Wear Limit	4.7505 inch (120.663 mm)


MAIN BEARING CAP
MICROMETER
5
10
15
0
25
30
MAIN BEARING BORE
CYLINDER BLOCK

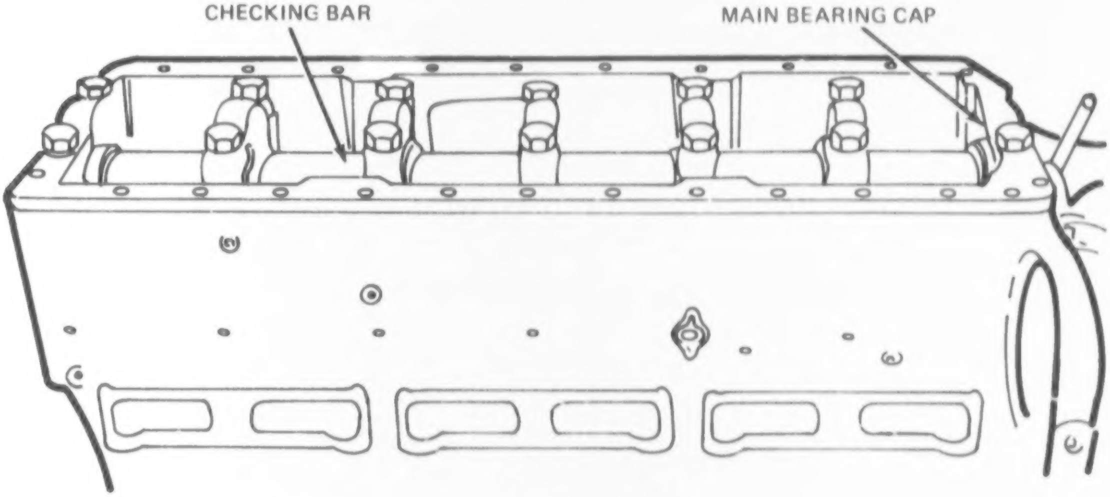
TA 073713

Figure 3-32. Checking Main Bearing Bore for Out-of-Round.

NOTE

Dimensions given are with main bearings torqued to operating tension.

j. Check the main bearing bore alinement with checking bar (fig 3-33). This highly precision-ground main bearing alinement checking bar will pass through all bores and turn freely unless the caps are not tightened or proper tension, burrs have not been removed, or the caps are distorted.



TA 073714

Figure 3-33. Checking Main Bearing Bore Alinement.

3-9. Repair.

a. Main bearing bore. Reaming of the main bearing bores is accomplished according to the following method.

CAUTION

Do not ream the main bearing bore indiscriminately. It should never be necessary to ream the main bearing bore unless a cap has been distorted or replaced. Use of a reamer must never replace use of the checking bar.

(1) Remove 0.002-0.003 inch (.051-.076 mm) of stock from the bottom milled surface of the main bearing caps which are out of alinement. Remove the stock by lapping or surface grinding.

NOTE

Omit this step if replacement caps are being used.

(2) Position a suitable reaming bar in the block so the rear of the bar is piloted in two good main bearing bores (fig. 3-34).

(3) Install all main bearing caps in the block and tighten the capscrews to operating tension according to the following alternating tightening sequence steps:

(a)	Tighten to 145-155 lb-ft	(197-210 N·m)
(b)	Advance to 300-310 lb-ft	(407-420 N·m)
(c)	Loosen all capscrews.	
(d)	Tighten to 140-145 lb-ft	(190-197 N·m)
(e)	Advance to 300-310 lb-ft	(407-420 N·m)

(4) Lubricate the reamer cutters and main bearing bores in the block with engine lubricating oil. This will prevent reaming oversize and will allow a better finish.

(5) Use hand driver to turn the reamer (fig 3-34). This driver is loosely pinned to prevent up-and-down or side thrust of the reamer while it is being turned.

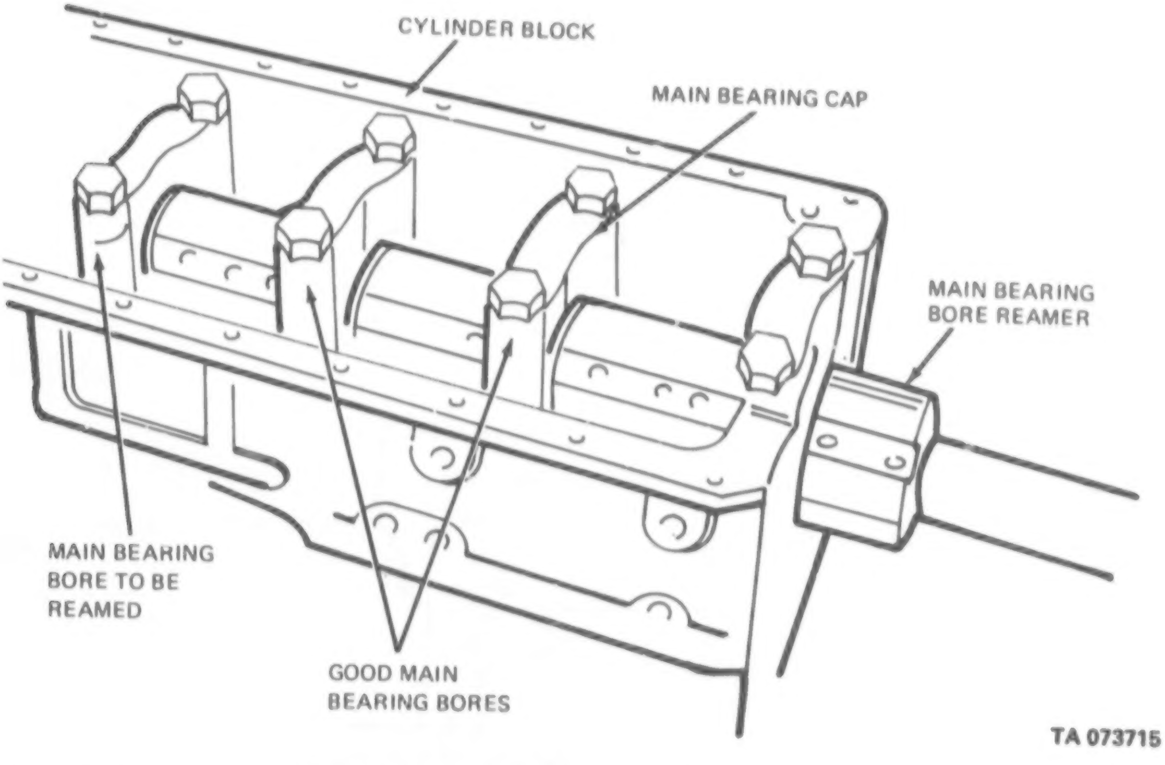

CYLINDER BLOCK
MAIN BEARING CAP
MAIN BEARING BORE REAMER
MAIN BEARING BORE TO BE REAMED
GOOD MAIN BEARING BORES
TA 073715

Figure 3-34. Reaming the Main Bearing Bore.

(6) Run the reamer through the remaining main bearing bores without backing up or reversing.

(7) Check the bore with the checking bar and measure the bore diameter once again with a dial bore gage (fig. 3-34).

(8) Clean the block thoroughly.

b. Camshaft Bushing Removal and Installation.

(1) Remove the camshaft bushings using the bushing remover, mandrel, and driver.

(2) Install the camshaft bushing using the following procedures.

(a) Apply a light coating of oil on the outside diameter of the camshaft bushing.

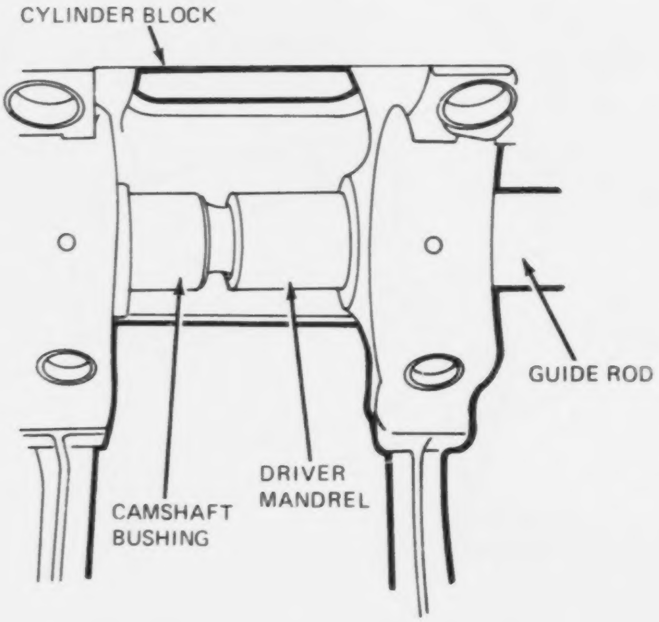
(b) Position the bushing on driver mandrel.

(c) Aline the oil hole in the camshaft bushing to the oil hole in the cylinder block.

NOTE

Number one camshaft bushing is wider; all other camshaft bushings are the same.

(d) Drive the camshaft bushing into position in the cylinder block using the same mandrel and driver (fig 3-35).



TA 073716

Figure 3-35. Installing the Camshaft Bushing.

NOTE

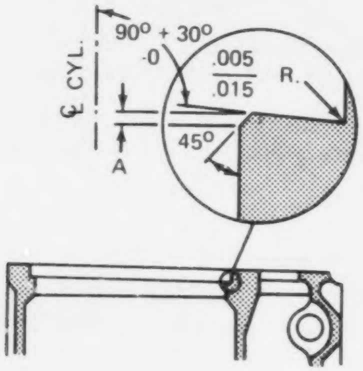
A length of drill rod can be utilized to check the camshaft bushing oil hole alinement from the main bearing bore.

NOTE

The number seven bushing must be pressed in from the rear.

c. Cylinder Liner Counterbore. Counterboring with counterbore tool:

(1) Check the counterbore tool bit before boring operation. A correctly ground tool bit will leave the counterbore surface completely flat or cupped to a 30-minute angle. The cup is preferred with an 0.005-0.015 inch radius as shown in figure 3-36.



TA 073717

Figure 3-36. Cylinder Liner Counterbore Cross Section.

(2) A correctly ground tool bit must be ground flat to sharpen (Fig 3-36). Point A is 0.012 inch (.3048 mm).

(3) Position the adapter plate in liner bore.

(4) Tighten the top and bottom locating pins by turning in the socket head screws.

(5) Set the tool adjustable sleeve so the blade just touches the bottom of the counterbore ledge. Use lubricating oil on cutter blades.

CAUTION

Never turn the tool counterclockwise. Doing so will damage the cutter blade.

(6) Turn the tool clockwise with even pressure.

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(7) Use a series of light cuts to clean up the entire circumference of the seat.

(8) Check the seat to determine if additional cuts are required.

CAUTION

Under no circumstances may the inside diameter of the ledge be lower than the outside diameter. A ledge that drops toward the center could contribute to cylinder liner breakage. The maximum counterbore depth after boring must not exceed the limit given in paragraph 3-11e.

(9) Chamfer the edge of the counterbore ledge 45° after counterboring (fig 3-36). Do not chamfer deeper than 0.013-0.024 inch (.33-.61 mm) to avoid reducing the liner seating area.

(10) Use shims to compensate for the metal removed and to restore liner protrusion to 0.003-0.006 inch (.076-.152 mm). Use as few shims as possible; i.e., use one thick shim in preference to two or more thinner shims.

Section IV. REPAIR OF CYLINDER LINERS

3-10. Cleaning. Most attempts to hone or deglaze liners provide worse results than leaving them "as is". Experience and laboratory results indicate that the liners need not be honed or deglazed to provide proper ring seating. The recommended procedure for preparing new or used liners (after removing the heavy carbon deposit and inspecting used liners for wear and surface deterioration) is as follows:

a. Wash the liners with detergent soap and warm water using a bristle (not wire) scrub brush.

b. Rinse the liners thoroughly – preferably with steam.

WARNING

Compressed air used for cleaning purposes will not exceed 30 psi. Use only with effective chip guarding and personal protective equipment (goggles/shield, gloves, etc.).

c. Blow the liners dry with compressed air.

d. Coat the liner bores generously with clean engine lubricating oil and let stand for 5 or 10 minutes.

e. Use white paper towels to wipe lubricating oil from the liner bores. Note the gray or black residue that appears with the oil on the white towels. Repeat the application of lubricating oil and wipe off with towels until the residue no longer shows.

f. Oil the liners lightly with clean engine lubricating oil and store them in a clean, dry location.

3-11. Inspection.

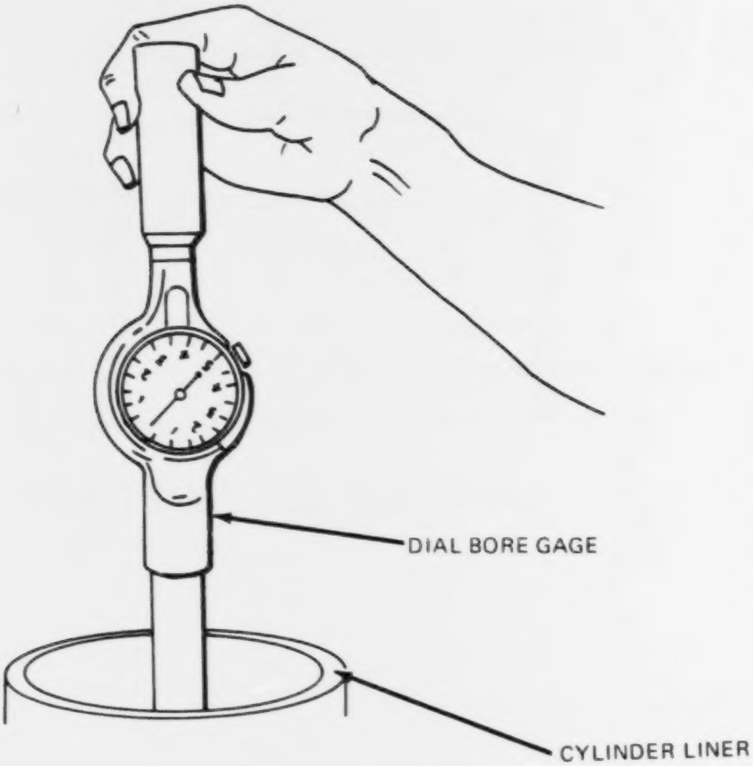
a. Check for cracks in cylinder liners just under the top flange, at the bottom of the liner, or above the top seal ring groove.

b. Check for excessive corrosion or erosion and pits. Discard if 1/16 inch (1.59 mm) or more.

c. Check the underside of the liner flange for dents, pitting, or fretting.

d. Discard the liner if any unevenness cannot be removed by lapping.

e. Check the liner bore with a suitable dial bore gage (fig 3-37). If the liners are worn more than 0.0040 inch (.10 mm) in excess of new liner maximum diameter, replace liner.



TA 073718

Figure 3-37. Measuring Liner Bore.

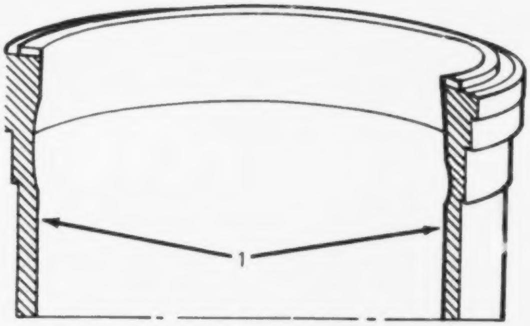
Liner dimensions are:

(1)	New Minimum	5.4995 inch (139.687 mm)
(2)	New Maximum	5.5010 inch (139.73 mm)
(3)	Wear Limit	5.5050 inch (139.83 mm)

NOTE

Dimensions should be checked at 60°F-70°F. New cylinder liners with lubrite finish may be 0.0002-0.0006 (0.005-0.015 mm) inch smaller than indicated due to lubrite coating.

f. Check and mark the liners to be used for ridge cutting, boring, or grinding and honing if worn less than the above limits and otherwise undamaged in area 1, figure 3-38.

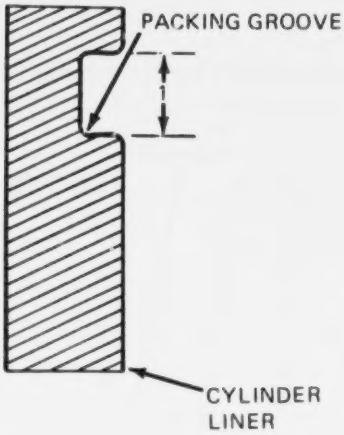


TA 073719

Figure 3-38. Worn Ridge in Cylinder Liners.

g. Check the liner packing groove contour and height as per the following specification and figure 3-39.

Dimension 1 .... 0.095 inch (2.41 mm)



TA 073720

Figure 3-39. Cylinder Liner Packing Groove Contour.

3-12. Repair.

a. Remove the ring ridge at the top of worn liners using a ring ridge cutter.

b. Hone the cylinder liner wall only enough to clean up and abrade the cylinder wall.

NOTE

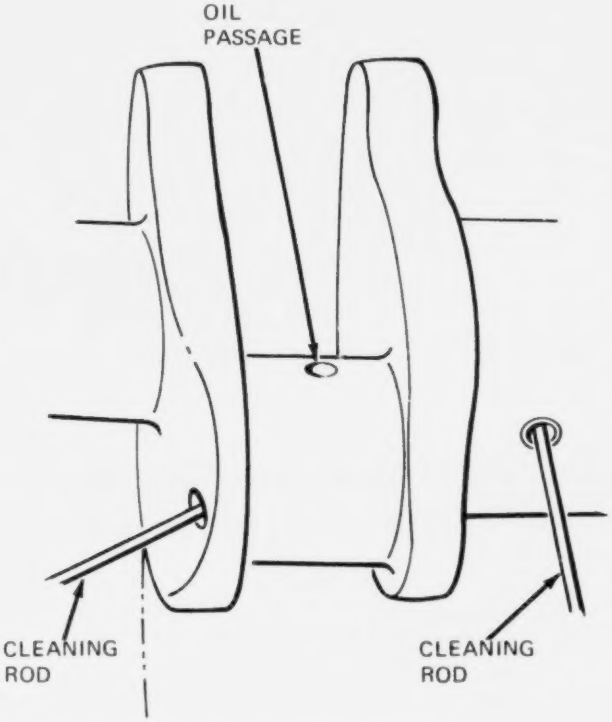
Cylinder liners can be honed out of the cylinder block by using a cylinder holding fixture.

Section V. REPAIR OF CRANKSHAFT

3-13. Cleaning.

a. Remove all pipe plugs.

b. Clean all drilled oil passages with a rod and cloth (fig 3-40).



TA 073721

Figure 3-40. Cleaning Drilled Oil Passages.

c. Refer to paragraph 3-2 for additional cleaning information.

d. Install and tighten the pipe plugs to 5 lb-ft torque.

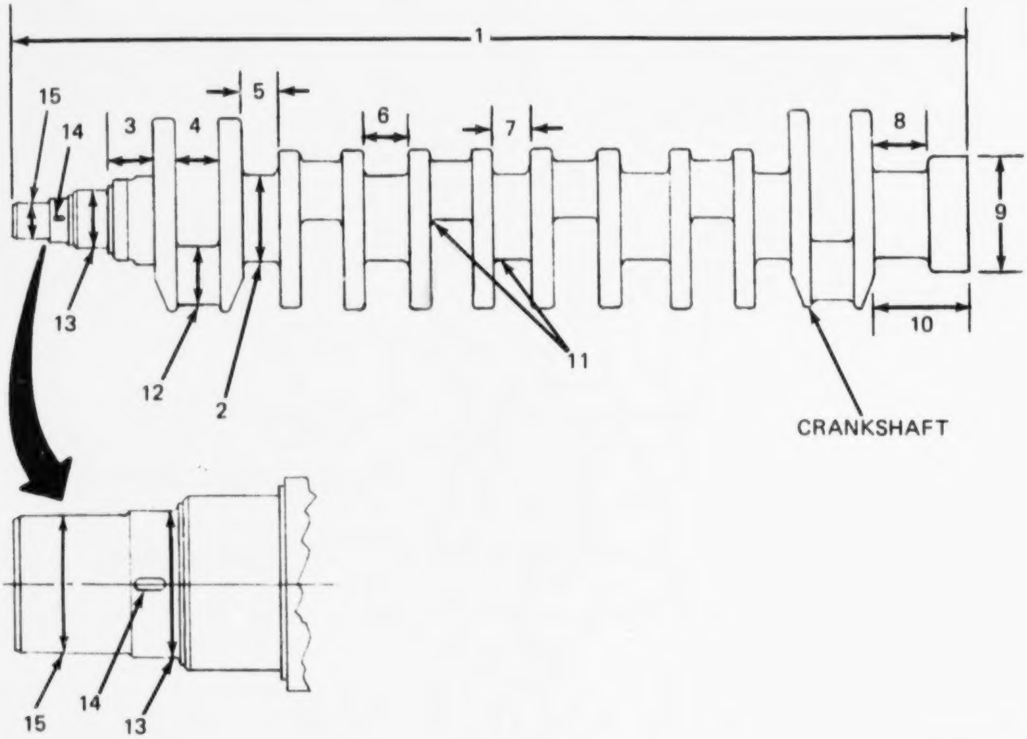
e. Stake the pipe plugs by making a 1/64 inch (0.0156 mm) indentation at the outside diameter of the threads with a center punch.

3-14. Inspection.

a. Inspect the crankshaft for scratches, nicks, cracks, and abnormal wear patterns.

NOTE

Refer to figure 3-41 for crankshaft dimensions and points of measurement.



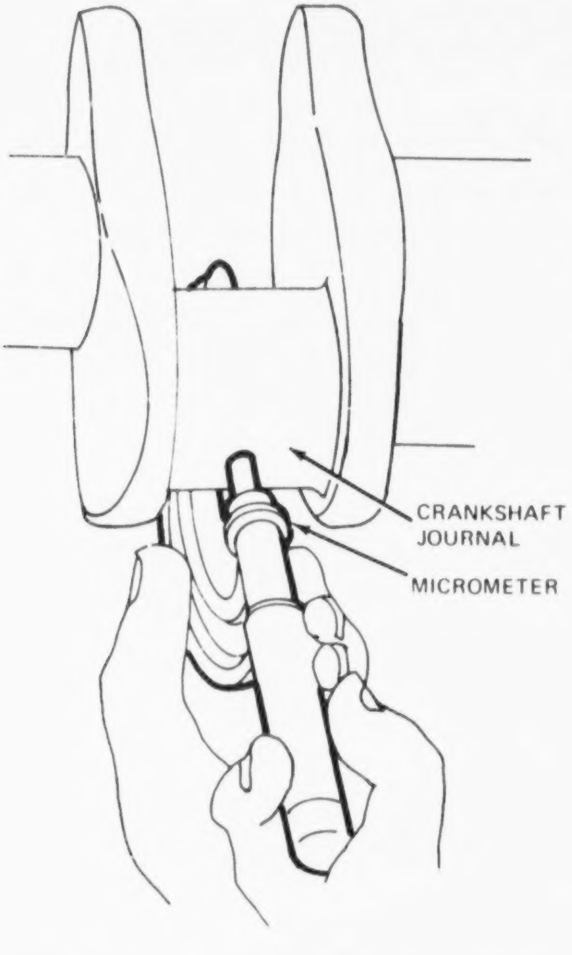
LEGEND:

1. 51.8125 INCH (1316.0375 MM)
2. 4.4985 TO 4.500 INCH (114.262 TO 114.3 MM)
3. 2.4375 INCH (61.9125 MM)
4. 2.126 TO 2.128 INCH (54.0004 TO 54.0512 MM)
5. 2.000 INCH (50.8 MM)
6. 2.500 INCH (63.5 MM)
7. 2.000 INCH (50.8 MM)
8. 3.001 TO 3.003 INCH (76.2254 MM)
9. 5.998 TO 6.000 INCH (76.2762 MM)
10. 5.151 TO 5.163 INCH (152.3492 TO 152.4 MM)
11. 0.172R TO 0.195R INCH (130.8354 TO 131.1402 MM)
12. 3.1235 TO 3.125 INCH (79.3369 TO 79.375 MM)
13. 3.7607 INCH (95.5217 MM)
14. 0.375 INCH (0.9525 MM)
15. 3.625 TO 3.626 INCH (92.075 TO 93.0 MM)

TA 239215 ■

Figure 3-41. Crankshaft Dimensions and Points of Measurement.

b. Measure the crankshaft journals with a micrometer for wear (figs 3-41 and 3-42). If the main bearing or connecting rod journals are worn out-of-round more than 0.002 inch, it will be necessary to regrind crankshaft.

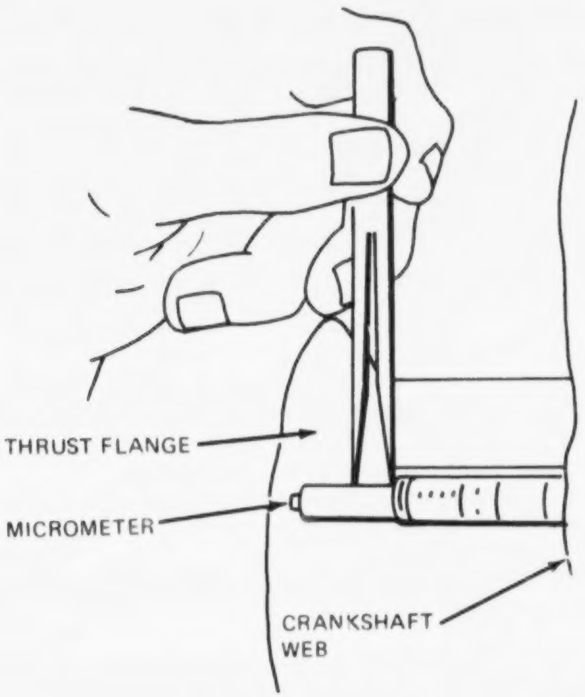

CRANKSHAFT JOURNAL
MICROMETER

TA 073723

Figure 3-42. Inspecting the Crankshaft Journal for Wear.

c. Critically check the crankshaft thrust flange at number seven main bearing for scoring, scratches, nicks, and breaks. If the surface is scored or scratched, the flange should be reground.

d. Measure the crankshaft thrust flange (fig. 3-43) by checking dimensions (8, fig. 3-41). If wear does not exceed 0.003 inch (0.0762 mm) at any one point, the flange condition is acceptable. If wear is 0.003 inch (0.0762 mm) or more, regrind the flange to restore flatness. If total wear and regrinding does not exceed 0.005 inch (0.127 mm), standard thrust rings may be used. If worn more than 0.007 inch (0.1778 mm), the flange should be ground for 0.010 or 0.020 inch (0.254 or 0.508 mm) oversize thrust rings or built up by electric arc welding and reground to specifications (8, fig. 3-41). Regrinding must clean up a minimum of 90 percent of the thrust surface and result in maintaining an installed crankshaft end clearance below 0.015 inch (0.381 mm).



TA 073724

Figure 3-43. Inspecting the Thrust Flange Wear.

e. Inspect rear seal area for roughness, scoring, grooving, flaking, pitting, galling, and correct size (9, fig 3-41).

f. Crankshafts with oversize thrust rings should be marked on the rear crankshaft counterweight. Both the thrust ring size and ring location should be included in stamping.

For example:

Front	0.010 inch (0.254 mm)
Rear	0.020 inch (0.508 mm)

g. Whenever structural damage has occurred to an engine, such as piston or valve breakage, etc., a magnetic inspection should be accomplished on the crankshaft as follows:

(1) Wet the complete surface with magnetic particle suspension before applying currents.

(2) The following directional magnetizing currents are to be used for crankshaft magnetic inspection or Magnaflux inspection:

	Direction of Defect	
	Longitudinal	Circumferential
DC-or-Rectified AC	1200 Amp	3600-4000 amp turns
AC Equipment	1400 Amp	4200-4700 amp turns
Magnetizing Method	Head Shot	Coil Shot

NOTE

Ampere turns in amperage flowing through coil multiplied by number of turns in coil; above is for 4-turn coil.

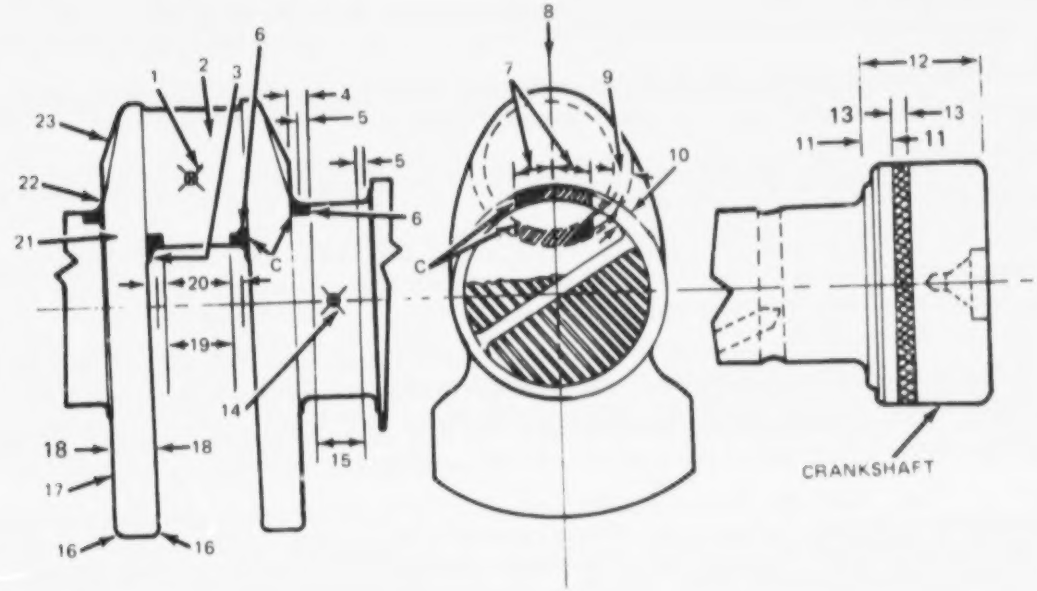
(3) Flow magnetic particle suspension over part in advance of placing part through coil. Turn current on the coil and move the coil full length of the part.

(4) If shaft parts are within 2 or 3 inches of the coil inside diameter, ample magnetism will be obtained if 3 shots of current are passed through coil while it is at each end and the center of part length.

(5) The limits of acceptability, unless otherwise stated, apply only to light slag or oxide stringers usually defined as inherent inclusions. Obvious cracks and circumferential or transverse defects are not acceptable.

NOTE

Figure illustration numbers and letter references in paragraphs (6) thru (24) are for figure 3-44.



LEGEND

1. CRANKPIN WALL
2. CRANKPINS
3. CRANKPIN WALL
4. FILLETS-MAIN JOURNAL-DEEP
5. MAIN JOURNAL FILLETS
6. CRITICAL REGION
7. FILLET DEPTH
8. MAJOR AXIS OR CENTERLINE OF ADJACENT WEB
9. JOURNAL SURFACE DEPTH
10. JOURNAL SURFACE THICKNESS
11. REAR SEAL SURFACE FACES
12. SEAL AREA
13. KNURLING
14. CHAMBER OF MAIN BEARING OIL HOLE
15. MAIN BEARING JOURNAL SURFACES
16. COUNTERWEIGHT WELDS
17. WEBS
18. WEB SURFACES
19. CONNECTING ROD BEARING CRANKSHAFT JOURNAL SURFACES
20. CONNECTING ROD BEARING CRANKSHAFT JOURNAL SURFACE FILLETS
21. WEB PERIPHERY
22. MAIN JOURNAL WALLS
23. FLANK CHEEK

TA 073725

Figure 3-44. Crankshaft Magnetic Inspection.

(6) Limits listed in the following steps must be maintained within region "C" (Critical Region) (6, fig 3-44). Dimensional value of "C" is the vertical distance measured downward from the crankpin centerline (22) and extending longitudinally for all crank webs between region (3) on the crankpin and region (1) on the journal.

(7) Indications located less than 1 inch from the major axis of centerline (22) (fig. 3-44) of adjacent web (measured circumferentially) must not exceed the following limits:

(a) Light indications in or entering fillets (11) are acceptable if not more than 1/8 inch long (open) or 1/4 inch long (subsurface).

(b) Light open indications on crankpin (21) and main journal walls (7) or bearing surface that extend closer than 1/8 inch to fillets (11), but do not enter fillets, are acceptable if 3/16 inch long or less. Light subsurface indications are acceptable.

(8) Indications located more than 1 inch from major axis or centerline (22) of adjacent web (measure circumferentially) must not exceed following limits:

(a) Light open indication in or entering fillets (11) are acceptable if 3/16 inch long or less. Light subsurface indications are acceptable.

(b) Light open indications on crankpin (21) and main journal walls (7) or bearing surfaces that extend closer than 1/8 inch to fillet (11) but do not enter fillet, are acceptable if 1/4 inch or less. Light subsurface indications are acceptable.

(c) Nicks on corners (16) of webs (17) are not acceptable. The part will be acceptable if the nick can be removed by grinding a 1/8 inch radius on the corner.

(d) Imperfections on web periphery (21) may be ground out to a depth of 1/8 inch maximum using a 1-1/2 inch minimum radius grinding wheel, provided balance limits are maintained.

(e) Light open indications that pass within 3/16 inch of a crankpin hole (1) are acceptable if 1/2 inch long or less and does not enter oil hole chamfer or intersect $45^{\circ} \pm 10^{\circ}$ diagonal. Only those subsurface indications that lay closer than 1/16 inch to the surface (measured at the chamfer at $45^{\circ} \pm 10^{\circ}$ diagonal) are not acceptable. All other subsurface indications are acceptable.

(9) Light open indications that enter chamfer of any main bearing oil hole (14) are acceptable if they are 3/8 inch or less. Subsurface indications ending in a main bearing oil hole (14) are acceptable.

(10) Fine subsurface salt and pepper type indications are permitted on upper and lower sides of crankpins (2) on the trimming line.

(11) Open longitudinal indications within region (15) which are less than 1-1/8 inch on main journals and 7/8 inch long on crankpins (6) are acceptable after the sharp edges have been honed 0.002-0.004 inch below journal surface.

(12) Longitudinal subsurface indications within area (15) or (19) are acceptable.

(13) Parallel open indications that meet requirement of (4) above, and other requirements on length and frequency, are acceptable.

(14) Parallel subsurface indications are acceptable.

(15) Indications that contain loose or foreign particles or voids left by such particles are not acceptable.

(16) Not more than three open indications are to appear on any one journal (15) or crankpin (2). Scattered small, open, or subsurface indications, four per crankpin (2), and six per main bearing (15), 1/8-inch long or less, if not forming part of a long intermittent indication or entering an oil hole (1) or (14) or fillet (4), will not be counted as indications in arriving at the total number permitted. However, if in addition to showing the maximum number of acceptable indications for the whole crankshaft, the part also shows many widely scattered short indications, it must be rejected.

(17) An inclusion which is intermittently open and subsurface shall be considered and measured as an open indication after the original indication has been wiped off. The entire modification must first meet the requirements for subsurface limits.

(18) Open and subsurface indications on counterweights and crankthrow bevel outside the critical region are acceptable.

(19) Open seams on web periphery that show visual depth on crankpin wall (10) may be removed from web periphery with a 1/2 inch radius wheel, provided at least 1/16 inch wall remains above crankpin fillet (11) after repair and balance limits are maintained.

(20) Seams or indications outside the critical region that extend over crank web periphery (6) but are not visible on the crankpin wall are acceptable.

(21) Indications due to weld defects are not acceptable in the counterweight welds. Indications at corner (23) may be ground out and blended to a depth not exceeding 1/4 by 5/8 inch long.

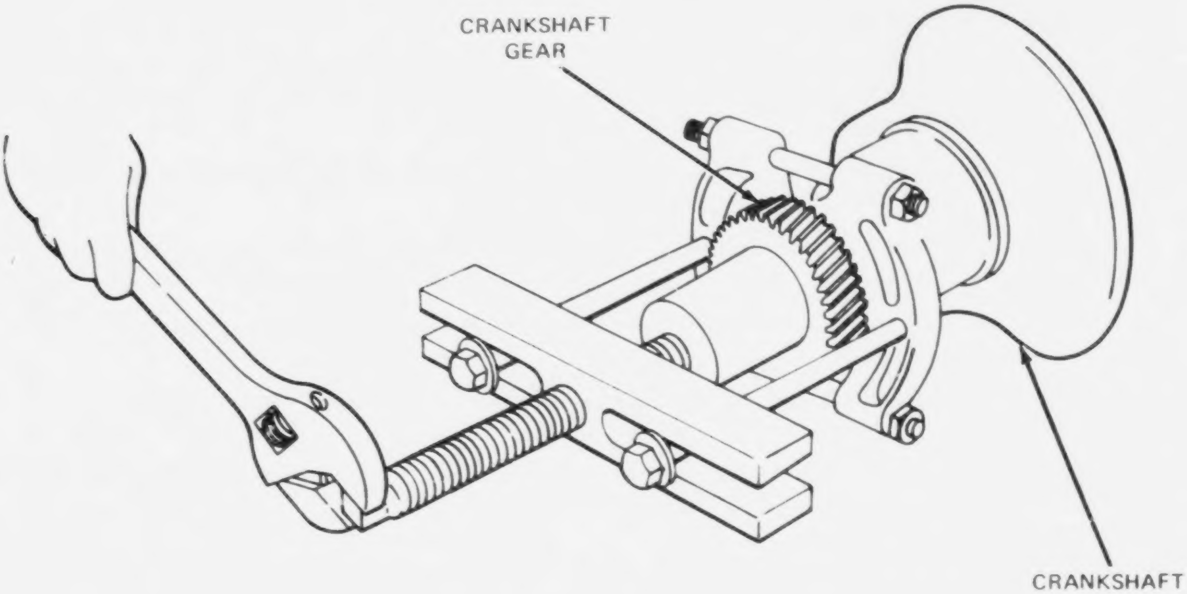
(22) Open longitudinal indications in the flywheel and thrust flange fillets longer than 3/8 inch are not acceptable.

(23) Limits of indications on the oil seal surface (which, when wiped clean to not show sharp edges) are acceptable.

(24) After inspection where coil shot is used, give crankshaft head shot to put magnetic poles at ends of crank, not throws. The residual magnetic field should not exceed two units on the Magna Flux Field Indication or equal.

3-15. Repair.

a. Using a suitable puller and wrench, remove the crankshaft gear (fig. 3-45).



TA 073726

Figure 3-45. Removing the Crankshaft Gear.

b. Buff all minor nicks and scratches, using crocus cloth.

c. Repair threads in threaded holes as required.

d. If inspection (para 3-14, above) shows the crankshaft is worn to a point where it must be reground and magnetic inspection shows it is suitable for regrinding, grind shaft to the next standard undersize. Do not exceed specifications shown in figure 3-41.

CAUTION

This operation must be performed by a shop with adequate equipment and fully trained personnel.

e. If crankshaft thrust flange is worn, repair as outlined in para 3-14, above.

CAUTION

Grind only the worn thrust face. Install oversize thrust rings on the wearing side only. Failure to do so will move the operating position of the crankshaft and cause extremely high wear.

f. Fillets (11, fig. 3-41) add greatly to strength of crankshaft. Reducing fillet radii or undercutting subtracts materially from that strength. Conversely, if fillets are larger than those specified in figure 3-41, bearing shells may be squeezed and will fail very quickly.

g. Grind the width of journals to clean up basic face surfaces as follows:

(1) If there are deep interruptions such as gouges or nicks that do not extend into fillets, smooth the edges with polishing paper.

(2) Maintain a limit of 0.030 inch (0.762 mm) over the maximum new crankshaft main bearing width specification (fig 3-41).

(3) The journal wall heights are not to be lowered to less than 0.010 inch (0.254 mm) from journal cheeks in regrinding journal bearing widths.

(4) All fillet and bearing surfaces should have the same finish as a new crankshaft.

h. Crankshafts requiring "off-stroke" grinding to clean up an unusually bad out-of-round crankpin can be ground off-stroke a maximum of 0.020 inch (0.508 mm) over or under mean stroke dimension of new crankshaft specifications. All crankpins must be reground to the degree of "off-stroke" required by the most out-of-round crankpin.

i. Maximum run-out on the thrust well main bearing shall be 0.002 inch (.051 mm).

j. Install the crankshaft gear as follows:

(1) Heat the gear with heating torch (not a cutting torch) to 400°F.

(2) Lubricate the flange and drive the gear onto the shaft with a piece of tubing.

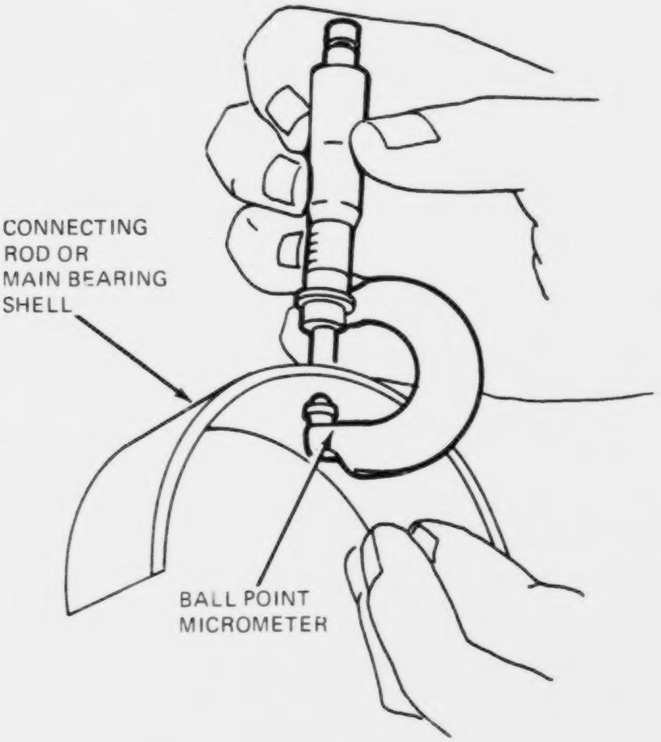
Section VI. REPAIR OF CONNECTING ROD AND MAIN BEARINGS

3-16. General. Main and connecting rod bearings (or shells) are two-piece units with one unit containing an oil hole for lubrication. Thrust rings are used at the rear main bearing.

3-17. Cleaning. Refer to paragraph 3-2 for cleaning information and instructions.

3-18. Inspection.

a. Gage the bearing shell using a ball point micrometer (fig 3-46).



TA 073727

Figure 3-46. Inspecting the Connecting Rod and Main Bearing Shells.

b. Discard bearing shells that are worn more than 0.002 inch. Refer to the following specifications for thickness of standard connecting rod and main bearing shells.

(1) Main Bearings

- *(a)* New Minimum . . . . 0.1230 inch (312 mm)
- *(b)* New Maximum . . . . 0.1238 inch (3.145 mm)
- *(c)* Wear Limit . . . . 0.1215 inch (3.086 mm)

(2) Connecting Rod Bearings

- *(a)* New Minimum . . . . 0.0942 inch (2.393 mm)
- *(b)* New Maximum . . . . 0.0947 inch (2.405 mm)
- *(c)* Wear Limit . . . . 0.093 inch (2.36 mm)

CAUTION

Do not scrape, lap, or file main or connecting rod bearing shells.

c. Inspect for total worn maximum oil clearance. A variance of 0.002 inch is allowed between adjacent main bearings. Refer to the following specifications.

(1) Main Bearing Shell Journal Clearance

(a)	New Minimum	0.0015 inch (0.038 mm)
(b)	New Maximum	0.0050 inch (0.13 mm)
(c)	Wear Limit	0.0070 inch (0.18 mm)

(2) Connecting Rod Bearing

(a)	New Minimum	0.0015 inch (0.038 mm)
(b)	New Maximum	0.0045 inch (0.114 mm)
(c)	Wear Limit	0.0070 inch (0.18 mm)

Section VII. REPAIR OF CONNECTING RODS

3-19. Cleaning. Refer to paragraph 3-2 for cleaning instructions.

3-20. Inspection.

a. Magnaflux all connecting rods, caps, and capscrews. Discard if cracks are detected.

NOTE

Be sure cap and rod are kept mated at all times.

b. Assemble cap to rod and alternately tighten capscrews to the operating tension utilizing the template method as described in the following tightening sequence steps.

(1)	Tighten to	70-75 lb-ft (95-102 N·m)
(2)	Advance to	140-150 lb-ft (190-203 N·m)
(3)	Loosen all	completely
(4)	Tighten to	25-30 lb-ft (34-41 N·m)
(5)	Advance to	70-75 lb-ft (95-102 N·m)
(6)	Advance to	140-150 lb-ft (190-203 N·m)

c. Check the crankpin bore and piston pin bushing using a dial bore gage or inside micrometer (fig 3-47). Bore diameter must be within 3.3157-3.3171 inch (84.219-84.254 mm) up to 30° on either side of parting line and 3.3157-3.3167 inch (84.219-84.244 mm) beyond 30° on either side of parting line. If either specification is not met, replace the rod.

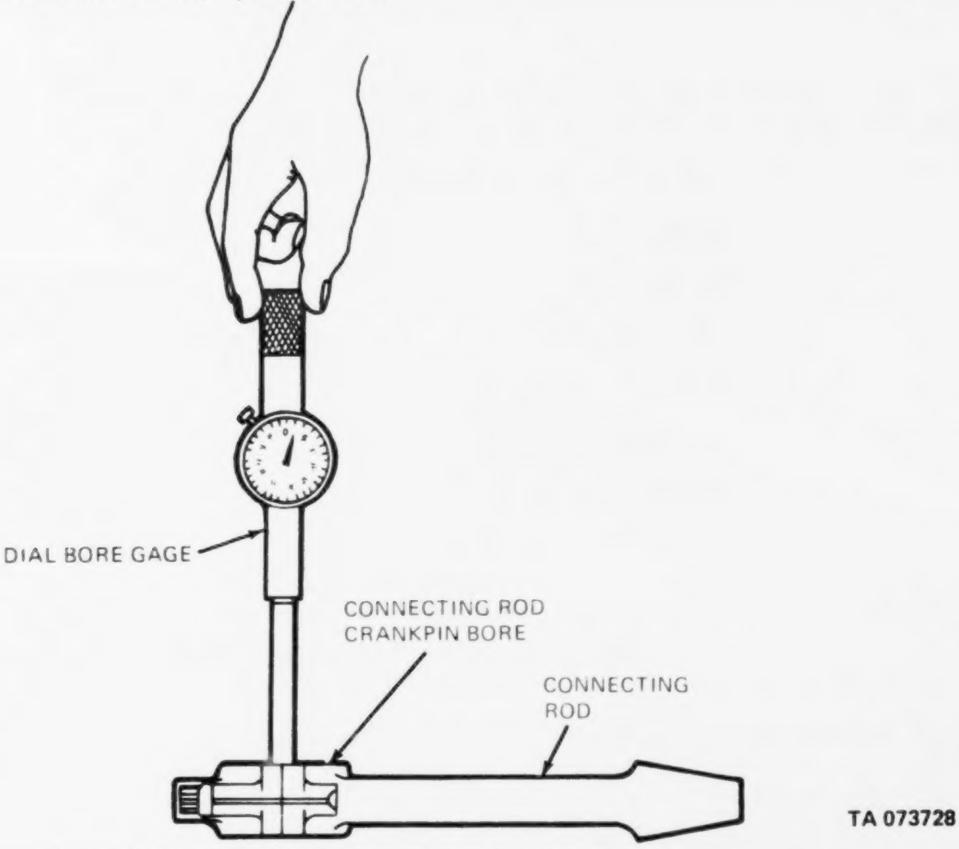


Figure 3-47. Inspecting the Connecting Rod Crankpin Bore.

d. Check the piston pin bushing with inside micrometer. If bushings do not meet specifications below, replace bushings.

(1) New Minimum . . . . 2.0010 inch (50.830 mm)

(2) New Maximum . . . . 2.0015 inch (50.838 mm)

(3) Wear Limit . . . . 2.0022 inch (50.856 mm)

e. Check connecting rod length and alinement using rod checking fixture 11600044 and locating mandrel.

(1) Calibrate the checking fixture for rod size.

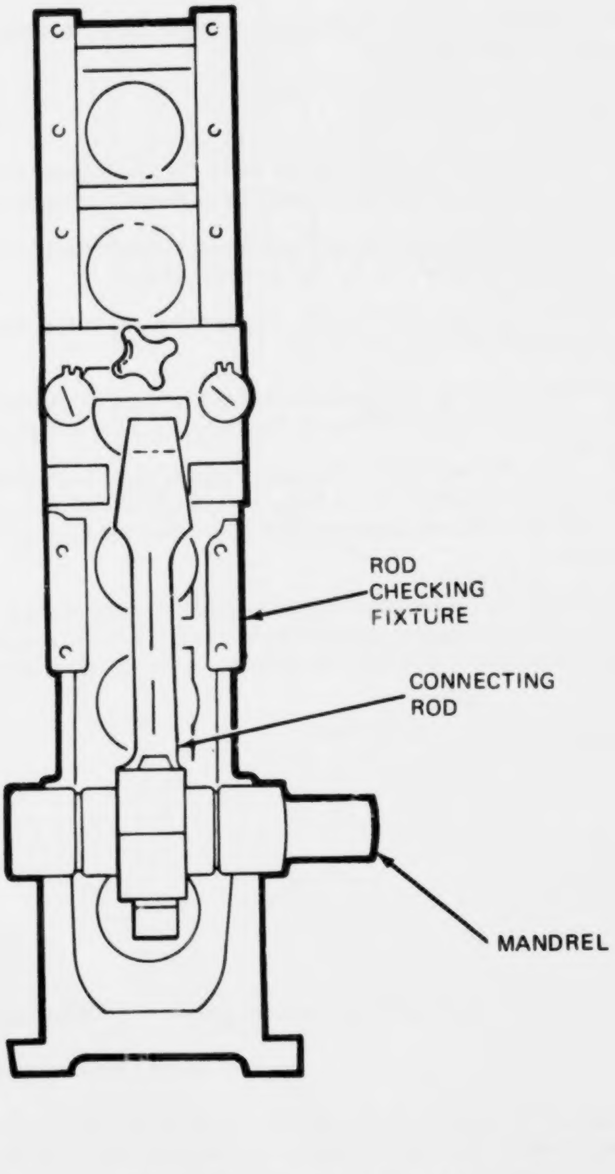
(a) Select a new rod that has been checked for correct absolute center length, 12 inches between bore centers. Production rods may vary from 11.998-12.000 inch (304.75-304.80 mm).

(b) Assemble the cap to the rod as described in paragraph 3-20 b, above.

(c) Insert the piston pin, furnished in mandrel set, in the piston pin bore.

(d) Install the locating mandrel in the crankpin bore.

(e) Set the rod in the fixture (fig 3-48).


ROD CHECKING FIXTURE
CONNECTING ROD
MANDREL

TA 073729

Figure 3-48. Checking Connecting Rod Bore Alinement

(f) Move the dial holder so the dials indicate on the piston pin.

(g) Zero the dial indicators.

(h) Lift the rod, mandrel, and pin assembly from the fixture. Turn horizontally 180°. Set back in fixture.

(i) Readjust the dial indicators to divide the difference between the first and second readings. The fixture is now calibrated.

(2) Check the rod alinement.

(a) Measurements read directly from the dial indicator indicate comparative length and misalinement of bores. Measurements apply with or without the bushing installed.

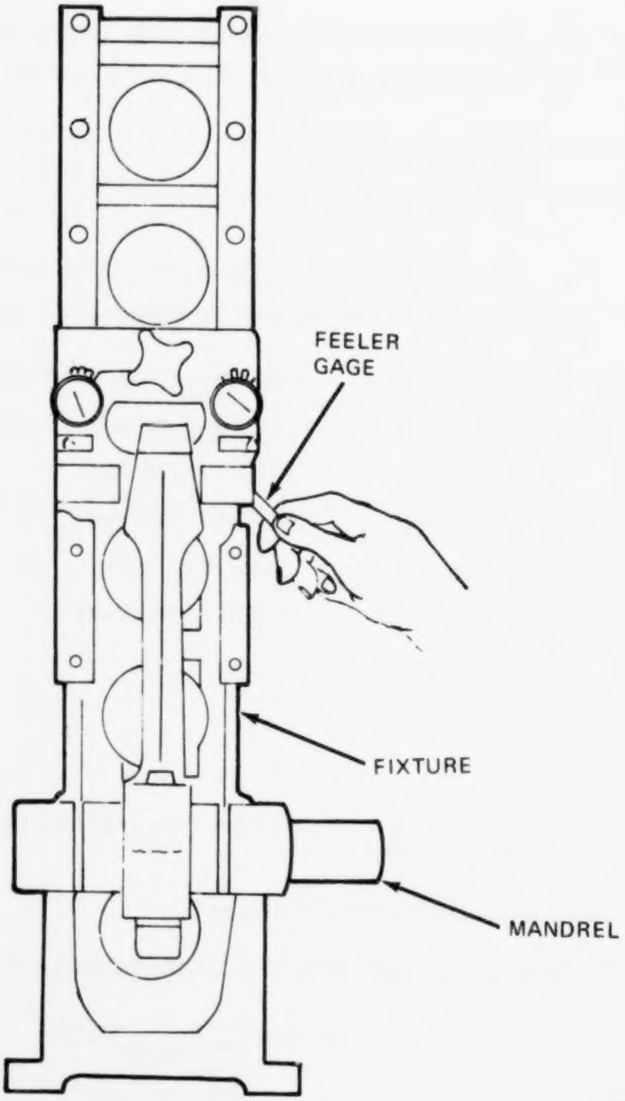
(b) Assemble the piston pin and mandrel (furnished with mandrel set) in the rod to be checked as described in paragraphs *(1) (b), (c) and (d), above.*

(c) Set the rod in the fixture. Be sure the pin in the mandrel is down and locked in position in the centerline of the rod.

(d) Take readings for length (compared to the length set up in the calibration of the fixture) and misalinement of bores (difference in reading from one indicator to the other).

(e) Turn the rod 180°. The total reading must not exceed 0.004 inch (0.010 mm) when the connecting rod does not contain the bushing or 0.0015 inch (0.038 mm) with the bushing installed and bored to size. This is combined with the plus and minus readings of indicator. Length must read 0.001 inch on indicators.

(f) Measure rod twist with a feeler gage between the piston pin and dial indicator holding plate (fig 3-49). When measuring the connecting rod twist, and the rod does not contain the piston pin bushing, twist must not exceed 0.004 inch (0.010 mm) with the bushing installed and bored to size.



TA 073730

Figure 3-49. Checking Connecting Rod Twist.

(3) Check the capscrews and bolt holes.

(a) Capscrew heads must rest squarely on the milled surfaces of the rod. If the capscrews have been tightened excessively, they may be permanently stretched, in which case they must be discarded. Discard capscrews if smallest diameter is less than specifications below:

(1)	New Minimum	0.584 inch (14.83 mm)
(2)	New Maximum	0.590 inch (14.99 mm)
(3)	Wear Limit	0.583 inch (14.81 mm)

(b) Discard all capscrews that have distorted threads.

(c) Check the cap outside diameter in the rod cap. If diameter exceeds limit below, discard cap.

(1)	New Minimum	0.638 inch (16.21 mm)
(2)	New Maximum	0.643 inch (16.33 mm)
(3)	Wear Limit	0.637 inch (16.18 mm)

(d) Check the dowel and pilot measurements. If these limits are exceeded, discard the rod.

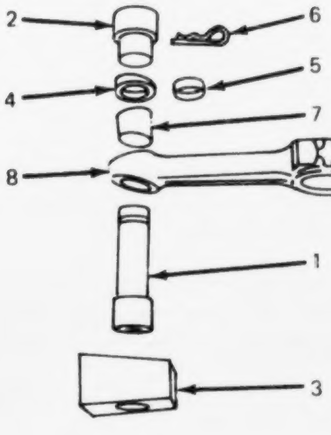
	New Minimum	New Maximum
Dowel Diameter	0.3127 (7.849 mm)	
Rod Dowel Hole	0.3128 (7.851 mm)	0.3133 (7.864 mm)
Dowel Protrusion	0.220 (5.52 mm)	0.250 (6.28 mm)
Dowel Press Fit-In Cap	0.0001 (0.003 mm)	0.0006 (0.015 mm)

3-21. Repair.

a. Remove nicks and dents which are less than 1/32 inch (0.03125 inch) deep by grinding or filing using a No. 3 half-round file.

b. Replace piston pin bushings as follows:

(1) Remove worn bushings with a suitable mandrel and removal sleeve (5, fig. 3-50).



LEGEND:

1. MANDREL
2. CUP
3. BLOCK
4. SLEEVE, INSTALLATION
5. SLEEVE, REMOVAL
6. PIN
7. BUSHING
8. ROD

TA 073796

Figure 3-50. Removing and Installing the Piston Pin Bushing in the Connecting Rod.

(2) To install a standard size bushing (7) in the rod, assemble the bushing (7) on the mandrel (1), position the installation sleeve (4) then the cup (2) on the mandrel (1). Secure with the locking pin (6).

(3) Place the connecting rod on the block (3) and support it in a horizontal position.

(4) Insert the mandrel with all of the components listed in step 2 into the connecting rod bushing bore.

(5) Aline the installation sleeve (4) with the middle of the boss on the rod.

NOTE

Be sure to line up the oil holes.

(6) Using an arbor press, press the bushing into the bore until the installation sleeve (4) contacts the side of the rod pin boss.

(7) Check the oil hole alinement. A 1/8-inch rod must pass freely through the rod and bushing.

Section VIII. REPAIR OF PISTON AND PISTON RINGS

3-22. Cleaning.

a. Clean pistons in a solvent cleaning bath that will not attack aluminum, or blast with suitable material that will not embed in or remove metal from the pistons.

b. Refer to paragraph 3-2 for additional cleaning instructions.

NOTE

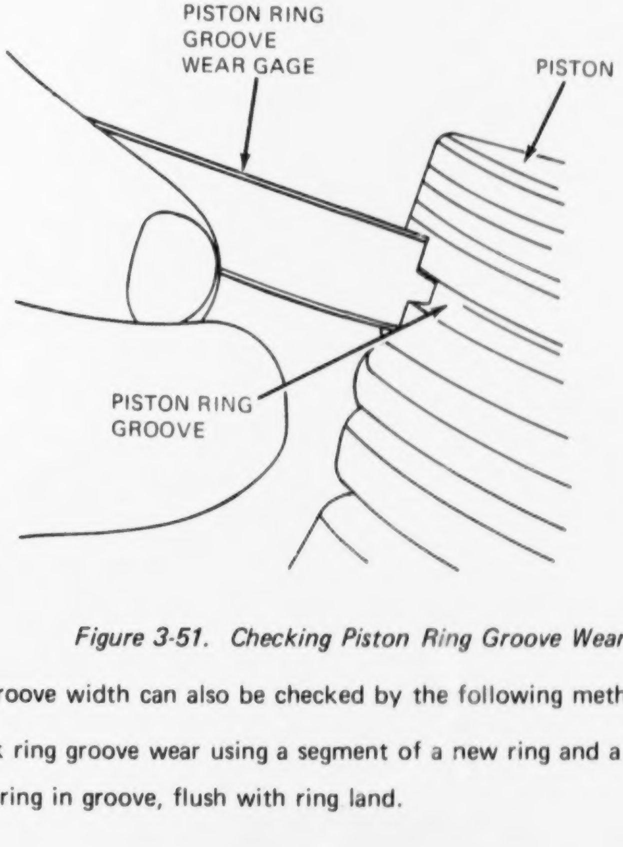
Piston skirts are coated with a plating that may blister if overheated.

3-23 Inspection.

a. Check the piston for cracks, breaks, scoring, galling, and scratches.

b. Inspect all ring grooves for missing sections, breaks, cracks, distortion, and galling.

c. Check the top and second ring grooves with ring groove gage (fig 3-51). Shoulders of gage must not touch ring groove lands. If shoulders of gage touch, discard the piston.



TA 073731

Figure 3-51. Checking Piston Ring Groove Wear.

d. The ring groove width can also be checked by the following method:

(1) Check ring groove wear using a segment of a new ring and a feeler gage.

(2) Hold ring in groove, flush with ring land.

(3) Insert 0.006 inch (.152 mm) feeler gage.

(4) If gage enters groove without forcing or disengaging ring, wear is excessive and piston should not be used.

e. Piston should be checked at a temperature of 70°F-90°F (21°C to 32°C).

NOTE

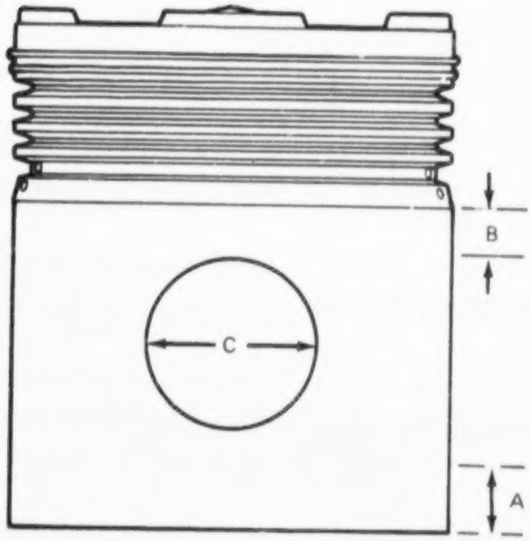
Piston to cylinder liner clearance may be computed after measuring piston and comparing with liner inside diameter.

f. Check measurement of piston skirt diameter using a micrometer at right angle to piston pin bore. A and B of figure 3-52 illustrates points of measurement.

(1) New Minimum . . . . 5.4870 inch (139.37 mm)

(2) New Maximum. . . . . 5.4880 inch (139.40 mm)

(3) Wear Limit . . . . 5.4830 inch (139.27 mm)



TA 073732

Figure 3-52. Piston Checkpoints.

g. Inspect piston pin bore at 70°F (21°C). The dimensions should be within the following limits (area C, fig 3-52).

(1) New Minimum . . . . 1.9985 inch (50.762 mm)

(2) New Maximum. . . . . 1.9989 inch (50.775 mm)

(3) Wear Limit . . . . 1.9990 inch (50.775 mm)

Add 0.0005 inch per 10°F up to 90°F (-12°C to 32°C).

CAUTION

Reboring of piston pin bores and use of oversize pins is not practical because the misalinement that results from such practice will cause seizure of piston or failure of connecting rod bearings.

h. Check the piston pin outside diameter using a micrometer. Pins must not be re-used if out-of-round more than 0.001 inch (.0254 mm) or worn smaller than the following dimensions:

(1)	New Minimum	1.9988 inch (50.768 mm)
(2)	New Maximum	1.9990 inch (50.775 mm)
(3)	Wear Limit	1.9985 (50.762 mm)

3-24. Repair.

a. Remove any small nicks or scratches from the piston using crocus cloth or a very small dressing file.

CAUTION

In the next step, do not drill the holes oversize.

b. Drill out all oil ring holes in the pistons using 1/8 inch (3.18 mm) twist drill.

Section IX. REPAIR OF CAMSHAFT

3-25. Cleaning.

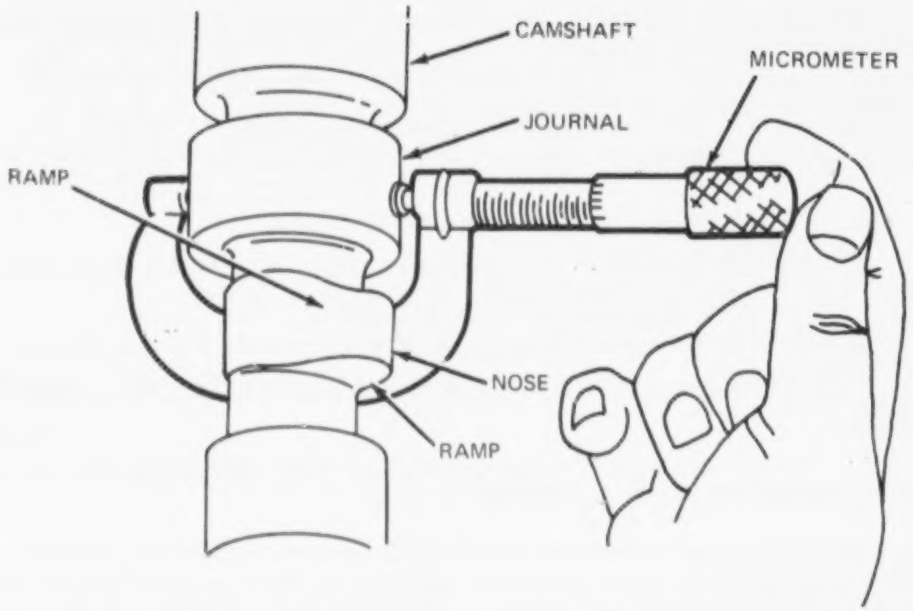
a. Steam clean the camshaft assembly.

b. Refer to paragraph 3-2 for additional cleaning instructions.

3-26. Inspection.

a. Check the camshaft journals with micrometer (fig 3-53). Replace the camshaft if the journals are worn beyond the limits below:

(1)	New Minimum	2.496 inch (63.40 mm)
(2)	New Maximum	2.497 inch (63.42 mm)
(3)	Wear Limit	2.495 inch (63.37 mm)



TA 073733

Figure 3-53. Measuring the Camshaft Journals.

b. Replace camshafts that have scuffed, scored, or cracked injector or valve lobes. Check by magnetic inspection (Magnaflux) for possible cracks.

(1) Limits of Acceptability for Injector Cam.

(a) Subsurface Longitudinal Indications:

1 None acceptable on nose.

2 Short longitudinal indications up to 0.625 inch (15.869 mm) long are acceptable in the critical region on the cam surface, 0.500 inch (12.695 mm) before the nose, and 0.375 inch (9.521 mm) after the nose.

3 Not more than two indications are allowable in the critical region of any one cam.

4 Light longitudinal indications not exceeding two in number are allowable outside the critical regions.

5 Parallel indications must be separated by at least 0.625 inch (15.869 mm) of metal.

(b) Open longitudinal indications. Open indications are not allowable except on base circle. A maximum of two longitudinal open indications 0.250 inch (6.348 mm) long or less will be allowed on base circle provided they are not closer than 0.250 inch (6.348 mm) and are visible only as a tightly closed line when the surface is wiped clean. Open indications shall not be closer than 0.1875 inch (4.761 mm) to the edge of the cam.

(c) Circumferential indications. Circumferential indications lying at an angle greater than 15° with longitudinal centerline are not allowable.

(2) Limits of Acceptability for Valve Cams.

(a) Subsurface Longitudinal Indications:

1 0.125-inch (3.17 mm) indications are allowable on nose.

2 Light longitudinal indications up to 0.500 inch (12.695 mm) of cam width are allowable on ramp.

3 Not more than two indications are allowable on ramp or nose of any one cam.

4 Light longitudinal indications not exceeding two in number are allowable on base circle of any one cam.

5 Parallel indications must be separated by at least 0.250 inch (6.348 mm) on ramp and nose and by 0.0625 inch (15.869 mm) on base circle.

(b) Open longitudinal indications. Open indications are not allowable except on base circle. A maximum of two longitudinal open indications 0.250 inch (6.348 mm) long or less will be allowed on base circle provided they are not closer than 0.250 inch (6.348 mm) and are visible only as a tightly closed line when surface is wiped clean. Open indications should not be extended closer than 0.1875 inch (4.761 mm) to edge of cam.

(c) Circumferential indications. Circumferential indications lying at an angle greater than 15° with the longitudinal centerline are not allowable.

(3) Limits of Acceptability for Bearings Surfaces.

(a) Subsurface indications. Subsurface indications are acceptable.

(b) Open indications. Four open longitudinal indications are permitted in each section of bearing provided not more than half of them extend full width of bearing. Edges of such indications are to be stoned, not to exceed 0.005 inch (0.127 mm) deep.

(c) Replace gear if chipped, cracked, or visibly worn.

3-27. Repair.

a. *Gear Removal.*

(1) Place the camshaft in a press between V-blocks. Heat gear with heating torch at 300°F (135°C).

CAUTION

Never support the gear on the outer gear surface. Always support the hub area.

(2) Press the camshaft from gear and remove the key.

b. *Gear Installation.*

(1) Heat the camshaft gear evenly to 400°F (190°C) with heating torch, not a cutting torch.

(2) Place the camshaft in a press and insert a new key. Press on the camshaft gear while hot. Maximum clearance between camshaft flange and gear face is 0.0015 inch (0.038 mm). Check the clearance with a feeler gage.

Section X. REPAIR OF FRONT GEAR COVER

3-28. Cleaning. Refer to paragraph 3-2 for cleaning instructions.

3-29. Inspection

a. Check the case cover (10), fig. 3-54) for distortion, breaks, cracks, and broken out sections.

b. Inspect the bushing (2) and seal (7 and 8) bores for smoothness and out-of-roundness.

c. Check the camshaft support (9) plate for deep scores, scratches, galling, cracks, and breaks.

d. Check the camshaft support (9) plate for wear beyond the point where removal of the shim (5) and packing (6) will not allow for correct camshaft end play.

e. Check the accessory drive bore bushing for wear. Refer to the following dimensions:

(1)	New Minimum	1.565 inch (39.75 mm)
(2)	New Maximum	1.569 inch (39.85 mm)
(3)	Wear Limit	1.571 inch (39.90 mm)

3-30. Repair.

a. Using crocus cloth or a small, fine file, remove all minor scratches and imperfections as required.

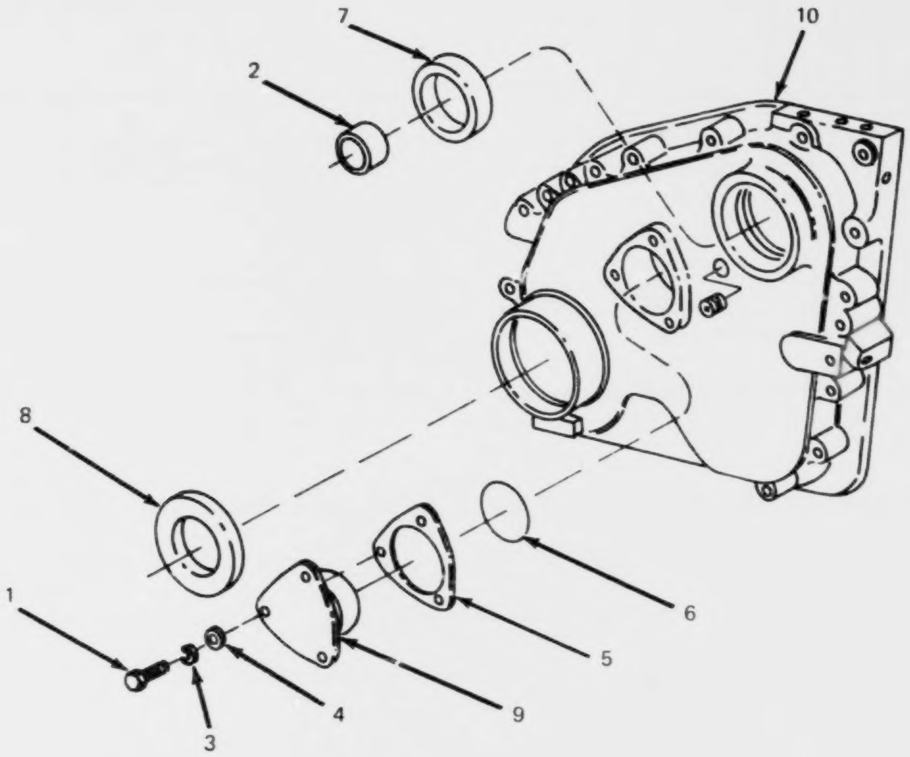
b. Using a surface plate, lap the front cover surface to block surface to eliminate any casting high and low areas.

c. Using a suitable remover and installer, replace the accessory drive bore bushing if worn larger than 1.571 inch (39.90 mm).

d. If the trunnion on gear case cover (fig 3-54) is to be "bushed," install as follows:

(1) Machine the gear case trunnion to 4.747–4.750 inch (120.57–120.65 mm) outer diameter.

(2) Press the bushing (fig 3-54) over the machined trunnion with the chamfered side of bushing toward the gear case.



LEGEND:

1. CAPSCREW
2. BUSHING
3. LOCKWASHER
4. WASHER
5. SHIM
6. PACKING
7. SEAL
8. SEAL
9. SUPPORT
10. COVER

TA 073734

Figure 3-54. Front Gear Case Cover—Exploded View.

Section XI. REPAIR OF CYLINDER HEADS AND VALVES

3-31. Disassembly and Cleaning.

a. Steam clean the cylinder heads and dry with air.

b. Place a cylinder head in a head holding fixture or equivalent.

c. Remove the valve springs. Using a suitable valve spring compressor, compress one valve spring at a time (fig 3-55). Tap the valve head lightly to loosen; then remove the half collets. Remove the valves, valve springs, and valve spring guides from the head.

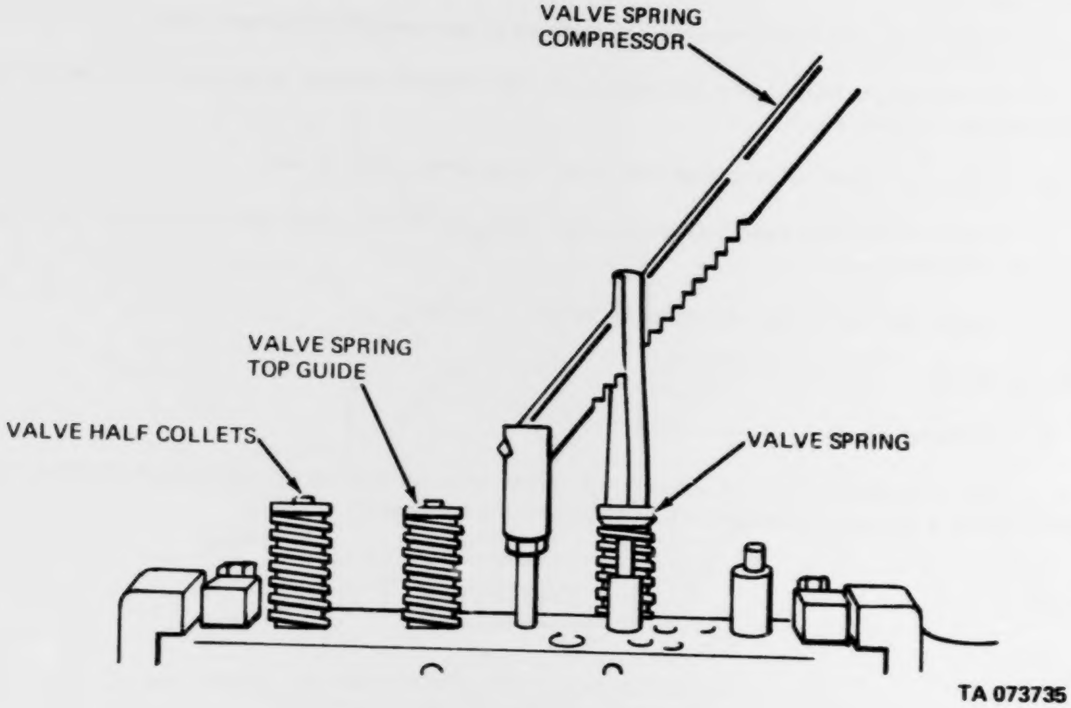

VALVE SPRING COMPRESSOR
VALVE SPRING TOP GUIDE
VALVE HALF COLLETS
VALVE SPRING
TA 073735

Figure 3-55. Compressing a Valve Spring.

d. Remove the pipe plugs from the fuel connector holes at the top rear of number three cylinder head and the top front of number one cylinder head (fig 3-56).

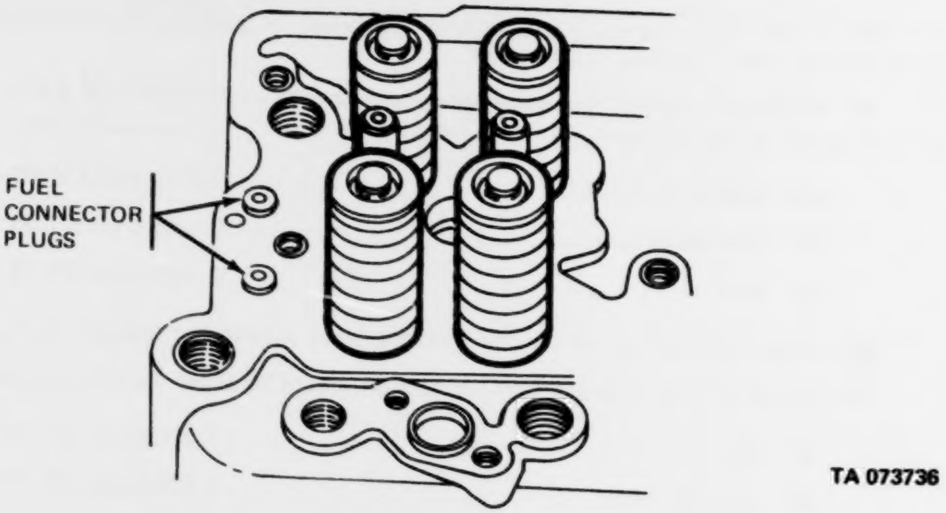

FUEL CONNECTOR PLUGS
TA 073736

Figure 3-56. Fuel Connector Plugs.

e. Remove all pipe plugs from the fuel passages in each end of the cylinder head.

f. Submerge the head in drycleaning solvent. Circulate the solvent to increase effectiveness on salt or lime deposits, grease, etc.

g. Clean the valves, valve springs, and collets by submerging in solvent.

h. Clean the cylinder head internal passages with a rod brush. Flush the passages with drycleaning solvent to remove deposits.

i. Check the lubricating oil passage to be sure it is open.

3-32. Inspection.

a. *Cylinder Heads.*

(1) Using a crocus cloth, polish the cylinder head surface lightly, just enough to shine the finish. This will allow a more complete inspection of the mating surfaces.

CAUTION

Do not use disk sander. Serious damage could result to the sealing surface of the head.

(2) Check the cylinder head for cracks, breaks, distortion, and broken out areas.

(3) Inspect the valve seat inserts for looseness in the cylinder head.

(4) Inspect the crosshead guide for straightness and for being at right angles with the milled surface of cylinder head. Replace, if not straight.

(5) Check the crosshead guides outside diameter with micrometers (fig 3-57). Refer to the following crosshead guide dimensions for worn replacement limits.

(a) New Minimum . . . . 0.4330 inch (11.00 mm)

(b) New Maximum . . . . 0.4335 inch (11.011 mm)

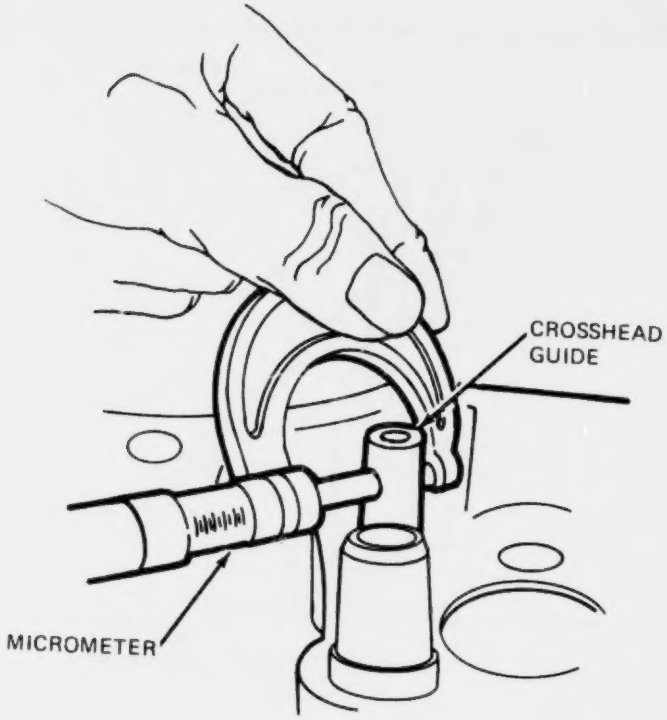
(c) Wear Limit . . . . 0.4320 inch (11.18 mm)

(6) Inspect the valve guide for chips, cracks, burrs, broken out sections, and extensive damage.

(7) Check valve guide protrusion. Protrusion should be as per the following specifications:

(a) New Minimum . . . . 1.3150 inch (33.401 mm)

(b) New Maximum . . . . 1.3250 inch (33.655 mm)



TA 073737

Figure 3-57. Measuring the Crosshead Guide.

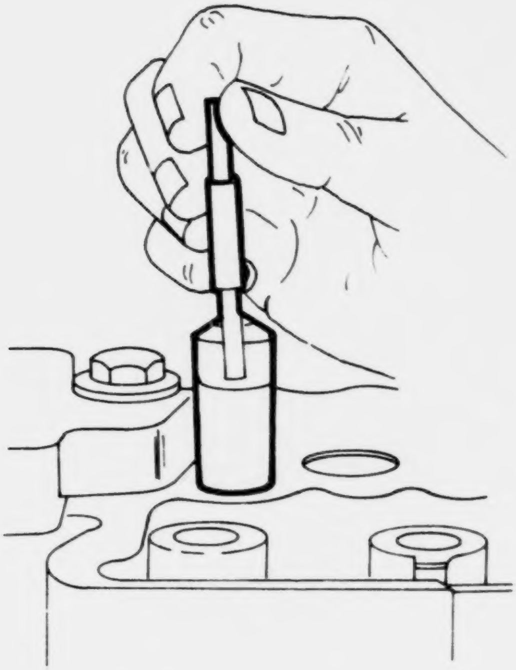
(8) Using a small bore gage, set it with accurate micrometers at 0.0002 inch (0.005 mm) larger than the worn replacement limit as shown in the following specifications:

(a) New Minimum . . . . 0.4525 inch (11.494 mm)

(b) New Maximum . . . . 0.4532 inch (11.511 mm)

(c) Wear Limit . . . . 0.4550 inch (11.56 mm)

(9) Use the bore gage as a "go-no-go" gage (fig. 3-58). Gage valve guide bore at several points crosswise and endwise of head.



TA 073738

Figure 3-58. Measuring the Valve Guide Bore.

(10) Replace all valve guides worn beyond the worn replacement below.

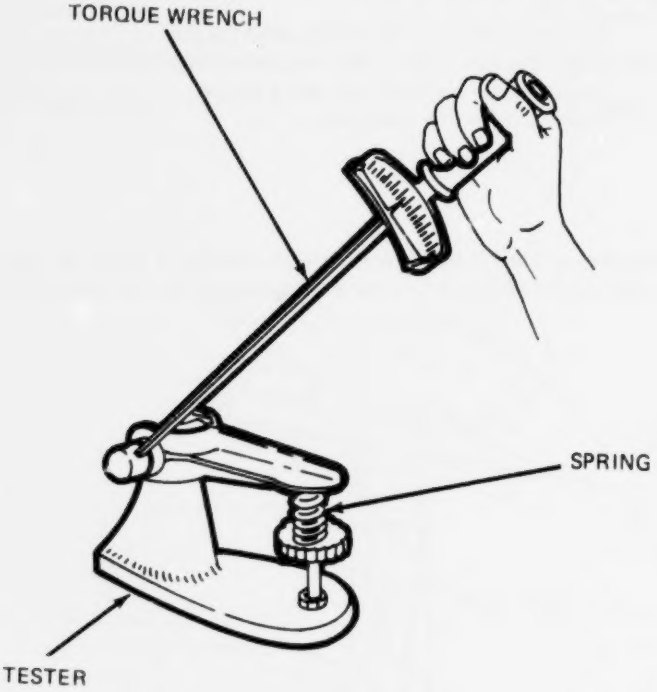
(a) New Minimum . . . . 0.4525 inch (11.494 mm)

(b) New Maximum . . . . 0.4532 inch (11.511 mm)

(c) Wear Limit . . . . 0.4550 inch (11.56 mm)

b. Valve Springs.

(1) Test each valve spring using a suitable valve spring tester (fig 3-59).



TA 073739

Figure 3-59. Testing Valve Spring Tension.

(2) Check valve springs for distortion, cracks, breaks, missing coils, and collapsed coils.

(3) Refer to the following valve spring specifications when testing valve springs.

(a) Approximate free length .... 2.685 inch (68.199 mm)

(b) Number of coils 9

(c) Assembled height .... 2.250 inch (57.15 mm)

(d) Wire diameter .... 0.177 inch (4.496 mm)

(e) Length .... 1.724 inch (43.79 mm)

(f) Required load for length

1. Lb-New Minimum .... 147.25 (66.79 Kg)

2. Lb-New Maximum.................. 162.75 (73.82 Kg)

3. Lb-Wear Limit .... 143 (64.86 Kg)

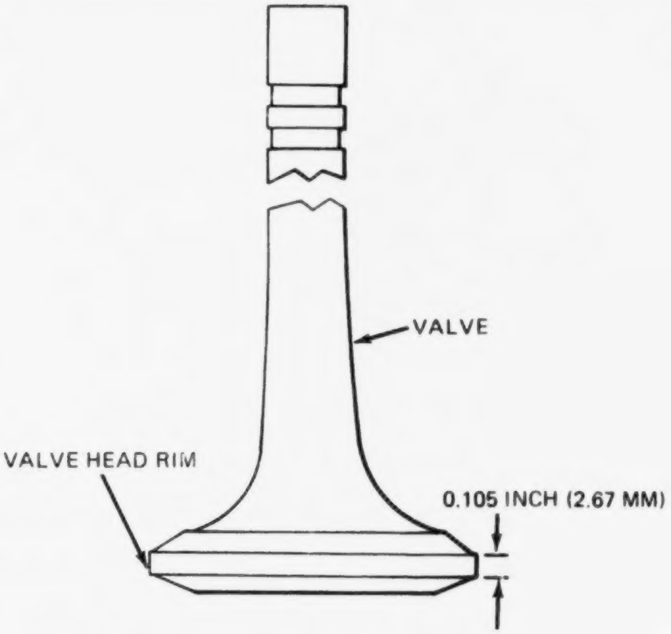
(4) If the valve springs compress to dimension shown, at less than load indicated under "worn limits," the valve springs must be replaced.

CAUTION

Spacers must be used under valve springs when the valve seat insert and valve have been refaced to make the valve spring check within the load limit.

c. Valves.

(1) Inspect all valves and discard if heads are cupped, cracked, pitted, or worn too thin to regrind within limits. Check valve head rim thickness for a minimum of 0.105 inch (2.67 mm) (fig 3-60).



TA 073740

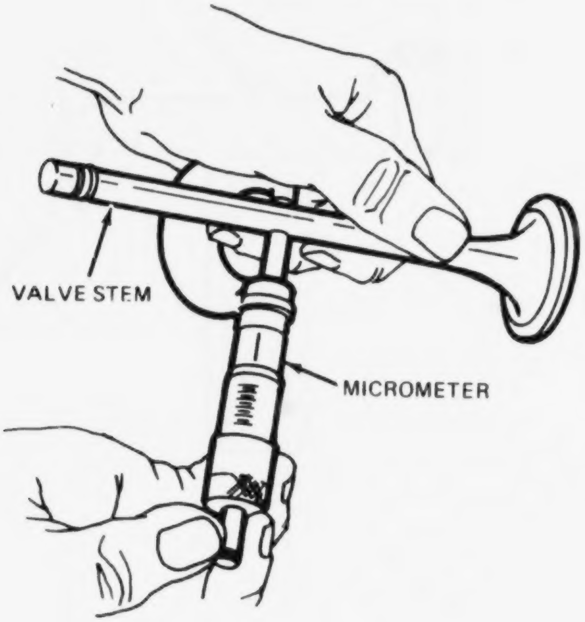
Figure 3-60. Inspecting Valve Head Rim Thickness.

(2) If the valve stems are scored or worn beyond worn limits below, replace the valves (fig 3-61).

(a) New Minimum .... 0.4500 inch (11.43 mm)

(b) New Maximum .... 0.4510 inch (11.46 mm)

(c) Wear Limit .... 0.4490 inch (11.41 mm)



TA 073741

Figure 3-61. Measuring a Valve Stem.

(3) If the collet recesses are worn so new collets will not fit securely in recesses, replace the valve.

(4) If the half collets are excessively worn or fit loosely on the valve recesses, replace the collet.

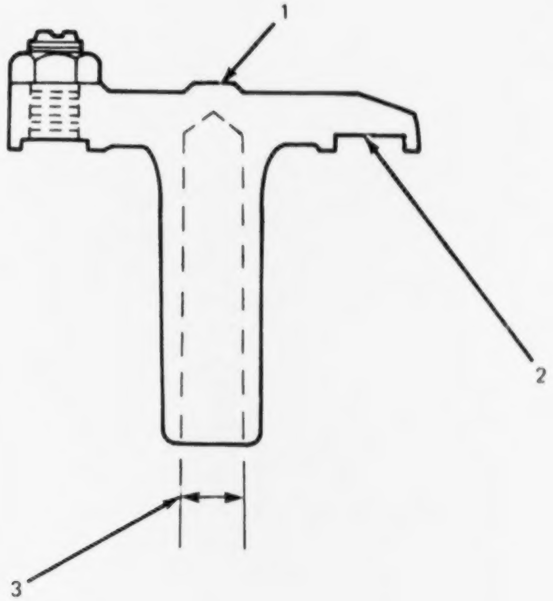
d. *Crossheads.*

(1) Inspect the crossheads for excessive wear, distortion, grooving, scoring, galling, stripped threads, broken out areas, and out-of-round.

(2) Check for cracks using the Magnaflux process.

(3) Using accurate micrometers, set a small bore gage 0.002 inch (0.051 mm) above the worn replacement limit. Use as a "go-no-go" gage in crosshead bore (3, fig. 3-62) to check for wear. Measure the outside diameter and check for wear beyond the replacement limits shown below.

(a)	New Minimum	0.434 inch (11.02 mm)
(b)	New Maximum	0.436 inch (11.07 mm)
(c)	Wear Limit	0.440 inch (11.17 mm)



TA 073742

Figure 3-62. Crosshead Dimensions.

(4) Check for out-of-round holes by gaging at several points 90° apart.

CAUTION

Do not use a plug gage for this operation.

(5) Mark crossheads for replacement that are not within worn replacement.

(6) Check for excessive wear on rocker lever (1) and valve (2) contact surfaces.

d. Valves.

(1) Wet-grind the valves to an exact 30° angle from horizontal.

(2) Valves and seats properly ground with precision equipment should not require lapping to effect an air-tight seal; however, a small amount of lapping is permissible if necessary in order to pass vacuum test, below.

(3) Check rim thickness. If rim is less than 0.105 inch (2.67 mm), valve is not suitable for use.

(4) Check the valve in a finish-reamed guide and against a newly ground valve seat face. Pencil mark the valve and drop it into position, rotate the valve 10°. A good seat will be indicated if all pencil marks are broken. If the pencil marks are not broken, valve seat tools need dressing or the machine has not been properly adjusted; the final check should be made with a vacuum tester.

(5) Conditions of a good valve seat.

(a) No grinding or reamer marks on the seating surfaces and within the guide.

(b) Valve face is a true 30° angle.

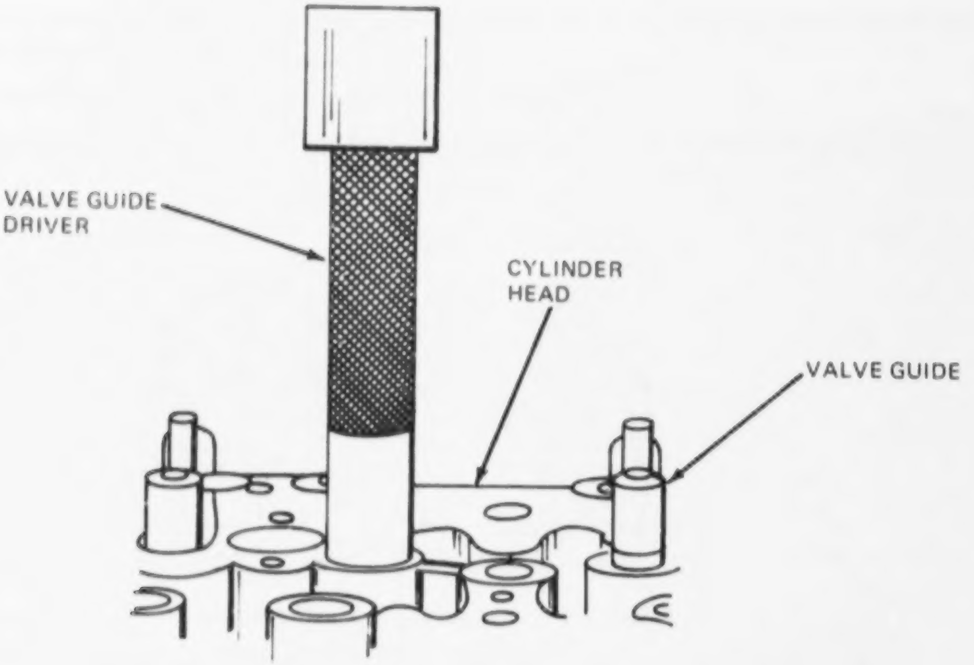
(c) Width of the grind is within limits.

e. Valve Guides.

(1) Using a step-punch, drive out worn valve guides from the underside of the cylinder head.

(2) Install new guides using an arbor press and mandrel (fig 3-64).

(3) If the correct valve guide mandrels are not available, press the guides into head to obtain 1.270-1.280 inch (32.26-32.51 mm) assembled height.



TA 073744

Figure 3-64. Installing a Valve Guide.

(4) Most valve guides will not require reaming. Insert new valve into guide and check for freedom of movement, or check guide with small bore gage to determine if guide bore is within limits below.

(a) New Minimum .... 0.4525 inch (11.494 mm)

(b) New Maximum .... 0.4532 inch (11.511 mm)

(c) Wear Limits .... 0.4550 inch (11.56 mm)

(5) If reaming is necessary, ream guide from bottom side of cylinder head to specifications *(4)* above.

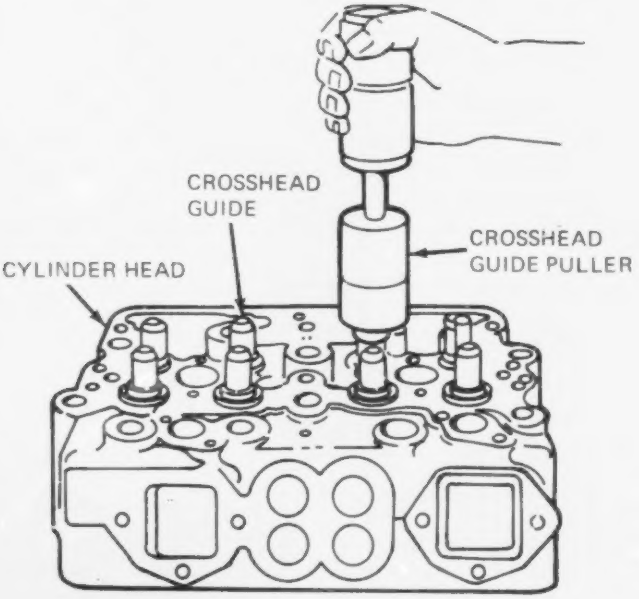
f. Valve Springs.

(1) A maximum of 0.09375 inch (2.38 mm) spacer may be used under the valve spring when head has been resurfaced and the valve and valve seat have been refaced.

(2) Repair of the valve springs is not possible. Replace the valve springs when any service problem involving the valve springs is encountered.

g. Crosshead Guides.

(1) Remove crosshead guides to be replaced using a crosshead guide puller (fig 3-65). Clean the holes thoroughly.

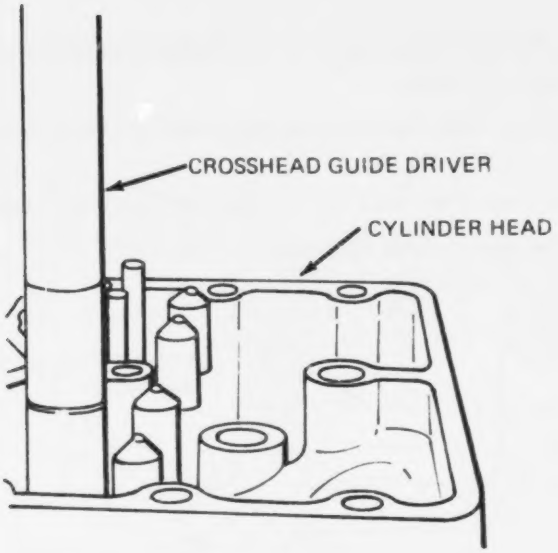


TA 073745

Figure 3-65. Removing a Crosshead Guide.

(2) Install new guides with a suitable crosshead guide driver (fig 3-66).

(3) If the mandrels are not available, press the guides into the head to obtain an assembled height of 1.860-1.880 inch, (47.24-47.75 mm).


CROSSHEAD GUIDE DRIVER
CYLINDER HEAD

TA 073746

Figure 3-66. Installing a Crosshead Guide.

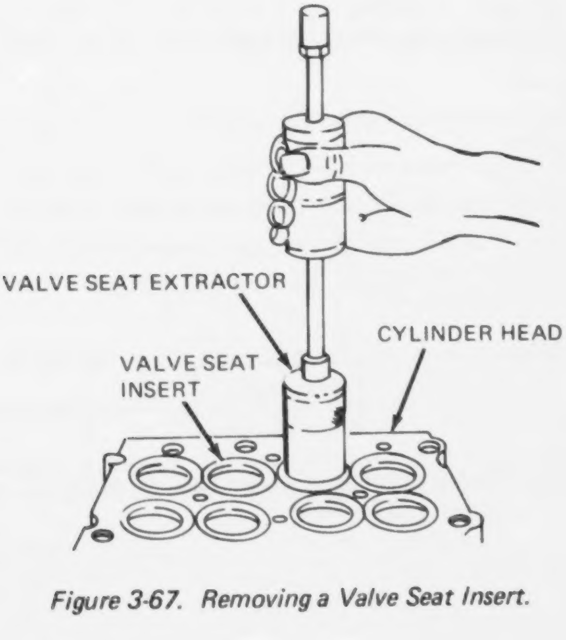
h. Valve Seats.

(1) Clean the area around valve seat.

(2) Using the puller (fig 3-67), adjust the extractor jaw depth with a new valve to ensure contact just under the valve seat to be removed.

(3) Insert the extractor into seat, making sure it is not canted.

(4) Expand the extractor so that the jaws make contact at a point between the valve seat and the cylinder head.


VALVE SEAT EXTRACTOR
CYLINDER HEAD
VALVE SEAT INSERT

TA 073747

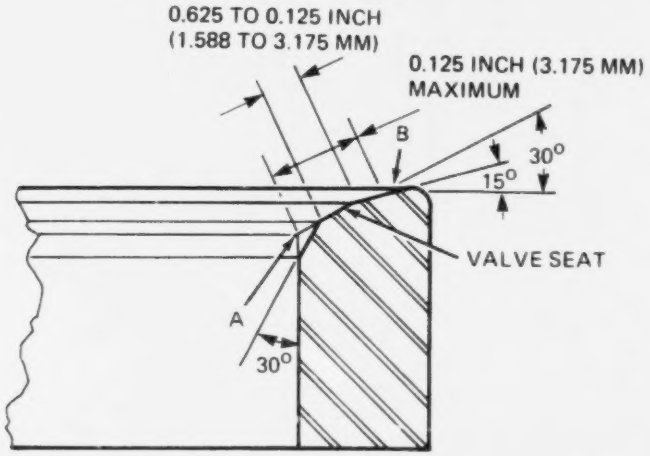
Figure 3-67. Removing a Valve Seat Insert.

(5) Using a slide hammer puller, an initial moderate blow followed by jaw adjustment is required to firmly seat the extractor jaws.

(6) Counterbore and resize the valve seat insert bore in the cylinder head using a counterbore kit.

(7) Drive the valve seat insert into the cylinder head valve seat insert bore.

(8) Grind the valve seat to valve specifications (fig 3-68).



TA 073748

Figure 3-68. Valve Seat Measurements.

(9) Check the valve seat for angular measurement (fig 3-70) and run out. Total run-out should not exceed 0.0002 inch (0.005 mm). If seating area is wider than 1/8 inch maximum, stock can be removed from points A and B, figure 3-68 with specially dressed valve seat grinder stones.

i. Injector Sleeve.

(1) Sleeve Removal.

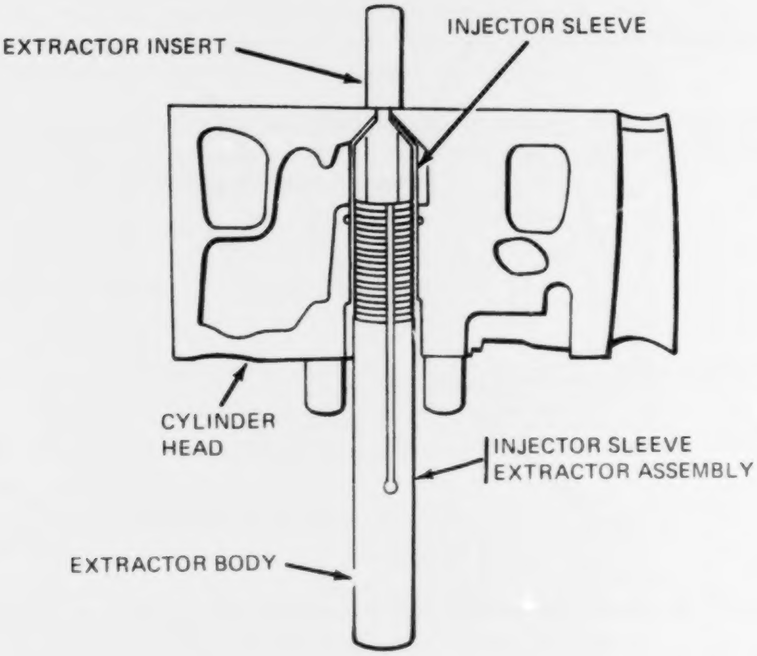
(a) Place the cylinder head upside down on an arbor press table and aline the press ram over the injector hole.

(b) Spread the support plates of the press just enough to insert the injector sleeve extractor body.

CAUTION

Do not attempt to support the extractor body; hold by hand.

(c) Install the injector sleeve extractor body up in the inside of the injector sleeve as far as possible (fig 3-69).



TA 073749

Figure 3-69. Removing an Injector Sleeve with an Injector Extractor.

(d) Place tapered end of extractor insert down through the injector hole and into the injector body.

(e) Apply pressure against the extractor insert with press while holding the extractor body up by hand.

(f) Continue pressing until the extractor body and sleeve come out of the cylinder head.

(g) Tap sideways against the extractor insert to loosen it and remove it from the extractor body.

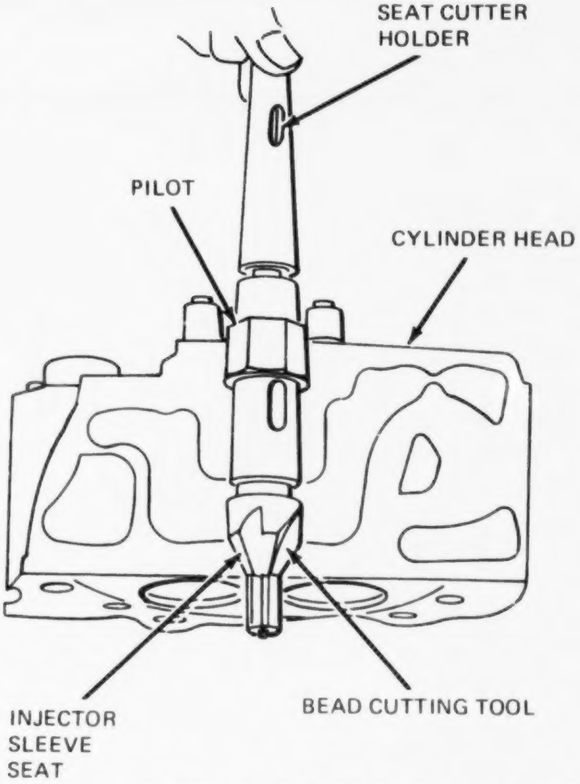
(h) Remove the injector sleeve from the extractor body.

(2) *Cleaning.*

(a) Remove all foreign material from the injector sleeve sealing area with a steel brush.

(b) Refer to paragraph 3-2 for additional cleaning instructions.

(3) *Inspection.* Inspect the sleeve seat area of the cylinder head for any damage done during cleanup. Machine the bead in the sleeve seat area of the head to provide an improved seal using a bead cutting tool (fig 3-70).



TA 073750

Figure 3-70. Machining the Injector Sleeve Bead Seat Using a Bead Cutting Tool.

(a) Install the bead cutting tool in a drill press using the pilot from sleeve cutter. Set the drill press speed at not more than 75 rpm. The cutter may also be turned by hand using a tap wrench.

CAUTION

Chattering may occur if drill press speed is over 75 rpm.

(b) Position the cylinder head on the drill press table, allowing clearance for the end of the bead cutter to protrude below the head surface into a pilot. The pilot can be made by recessing a 1/2 inch drill bushing in a plate which is centered below the drill spindle and secured in place.

(c) Before starting the drill press motor, insert the cutter, holder, and pilot into the injector bore to insure proper alinement.

(d) Lift the cutter, holder, and pilot; lubricate the cutter with cutting oil and start the cutting operation, applying a steady moderate pressure.

CAUTION

Do not cut more than 0.010 inch (0.254 mm) deep.

(e) When the proper depth has been attained, allow the cutter to dwell in position for approximately ten seconds to ensure a good seat and clean grooves.

(f) Remove the bead cutter, holder, and pilot from the drill press. Remove the bead cutter from the holder and pilot and install the injector sleeve seat angle cutter. This cutter is required to cut a 70° angle relief chamfer at top edge of 60° seat. Apply bluing at the 60° seat to aid in determining the amount of 70° cut needed.

(g) Lubricate and install the cutter, holder, and pilot. Attach a tap wrench to the adapter and rotate, applying an even pressure. When the lower edge of 70° angle is approximately 1/8 inch from top of bead, remove the cutter, adapter, and pilot.

(h) Remove the bluing from 60° seat.

(4) *Sleeve Installation.*

(a) Coat a new O-ring with clean engine lubricating oil. Shake excess oil from the O-ring.

(b) Install the O-ring into the groove provided in the sealing area of the injector sleeve bore.

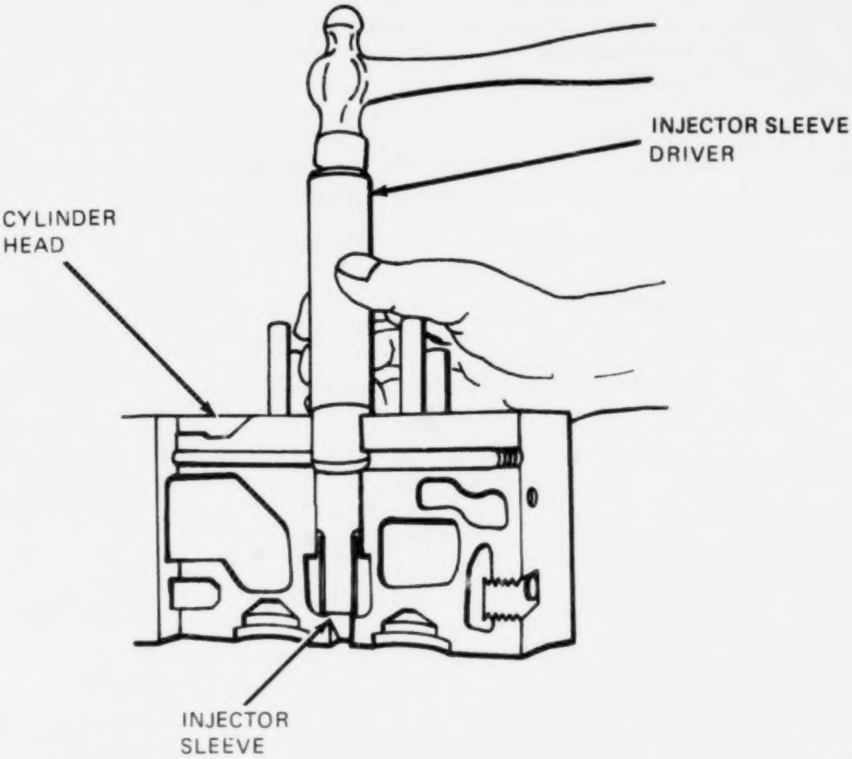
CAUTION

Make sure sleeve seat at bottom of injector bore is free from oil, carbon, or other foreign materials.

CAUTION

Do not strike driver with hammer during this step.

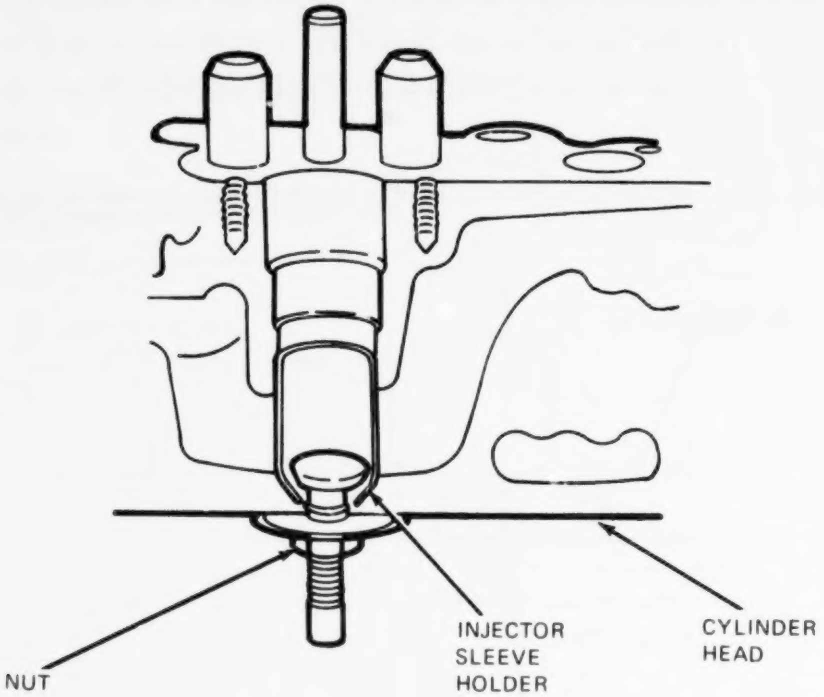
(c) Using sleeve driver, push a new injector sleeve into the bore of the cylinder head until it bottoms in the cylinder head (fig 3-71). Remove the sleeve driver.


INJECTOR SLEEVE DRIVER
CYLINDER HEAD
INJECTOR SLEEVE

TA 073751

Figure 3-71. Installing an Injector Sleeve.

(d) Install the injector sleeve holder, torque the nut to 35-40 lb-ft (47-54 N·m) (fig 3-72).


NUT
INJECTOR SLEEVE HOLDER
CYLINDER HEAD

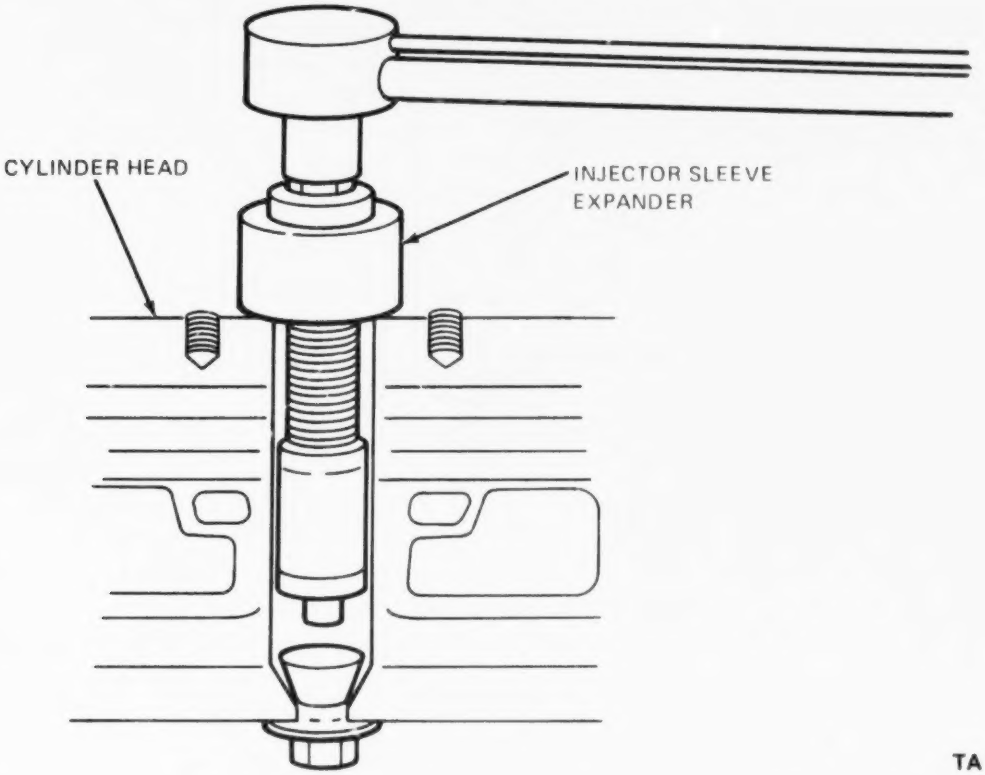
TA 073752

Figure 3-72. Installing an Injector Sleeve Holder.

(e) Using injector sleeve driver and a hammer, strike the driver two moderate blows to ensure that the injector sleeve is seated properly in the 60° seat at the bottom of the injector bore.

(f) Retorque the injector sleeve holder to 35-40 lb-ft (47-54 N·m).

(g) Roll the top 1/2 inch area of the sleeve with injector sleeve expander (fig 3-73).



TA 073753

Figure 3-73. Sealing the Upper End of the Injector with an Injector Sleeve Expander.

1 Grind flats on the top end of the expander mandrel to enable a socket and torque wrench to be used to turn the mandrel in the roller.

2 Lower the expanding roller into the injector sleeve.

3 Use a lb-in torque wrench to turn the mandrel. Turn the mandrel until a 75 lb-in (8.4 N·m) maximum torque reading is obtained on the torque wrench.

CAUTION

Over-rolling of the injector sleeve will cause deformation of the sleeve into the O-ring groove.

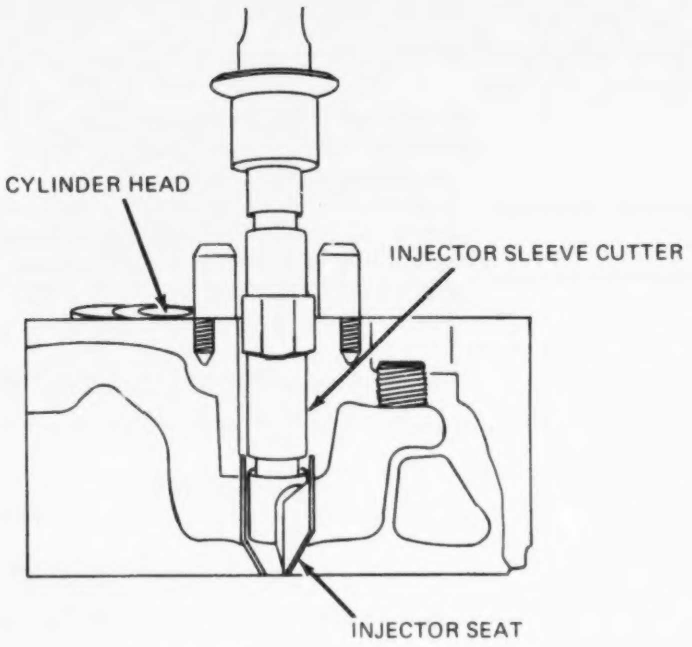
4 Remove the injector sleeve expander and injector sleeve holder.

NOTE

Do not roll lower area of injector sleeve.

(5) Injector Seats.

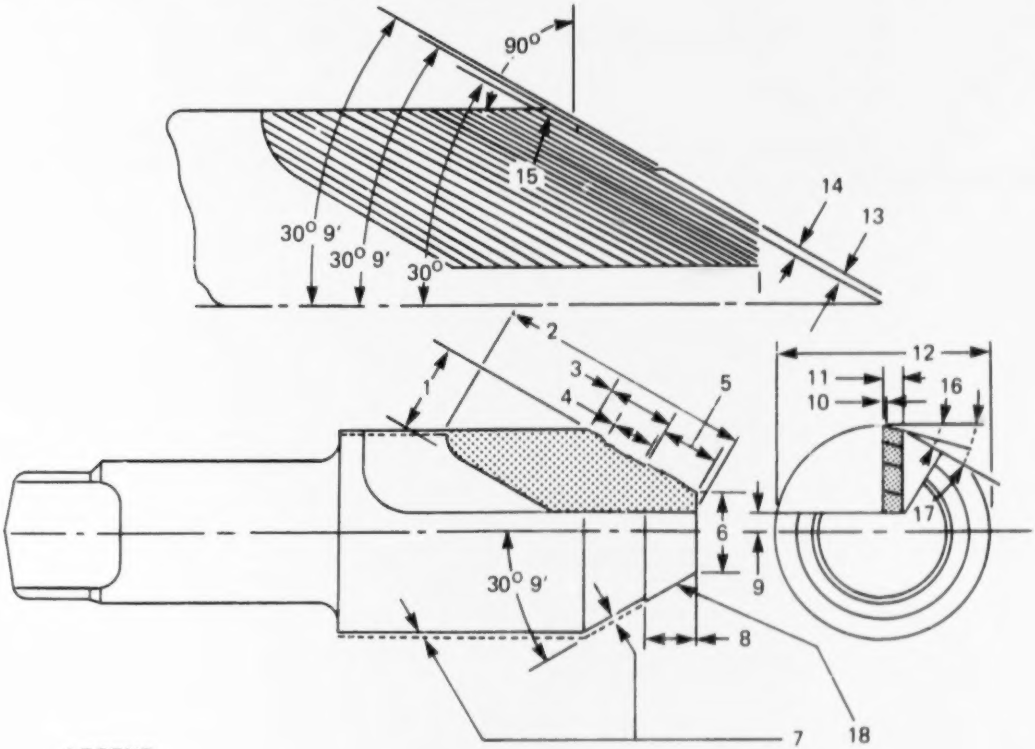
(a) Cut injector seat (fig 3-74) to provide proper injector seat and injector tip protrusion of 0.060-0.070 inch (1.52-1.78 mm).


CYLINDER HEAD
INJECTOR SLEEVE CUTTER
INJECTOR SEAT

TA 073754

Figure 3-74. Cutting an Injector Seat Using an Injector Sleeve Cutter.

(b) It is very important that the cutter be ground to the exact dimensions as per the following guiding specifications keyed to fig. 3-75.



LEGEND:

1. 0.375 INCH
2. 1.250 INCH
3. 0.3425 INCH
4. 0.226/0.236 INCH
5. 0.355/0.360 INCH
6. 0.375 INCH
7. 0.125 INCH
8. 0.312 INCH
9. 0.125 INCH
10. 0.010 INCH LAND WIDTH
11. 0.0937 INCH
12. 1.0615/1.0635 INCH
13. 0.0077/0.0097 INCH
14. 0.0015/0.0025 INCH
15. 0.080/0.090R INCH
16. 15° ANGLE RELIEF
17. 30° ANGLE RELIEF
18. 30° 9' ANGLE RELIEF

TA 073755

Figure 3-75. Injector Seat Cutter Dimensions.

(c) To determine the amount of cut, install injector and measure tip protrusion. Depth of cut should provide 0.060-0.070 inch (1.52 - 1.78 mm) protrusion of injector cup tip beyond milled face of cylinder head.

(d) The sleeve must "blue in", with Prussian blue, 360° around injector seat when injector is installed in cylinder head. Bluing band must be 0.060 inch (1.52 mm) minimum width.

3-34. Valve Assembly and Testing.

a. Valve Assembly.

(1) Clean the cylinder head, valves, springs, etc., before assembling.

(2) Dip valve stem into clean OE/HDO-30 oil.

(3) Place cylinder head face down on a wooden bench or protective surface to prevent marring the machined surface.

(4) Assemble the lower valve spring guide on the valve guides.

(5) Assemble the springs.

NOTE

Reground valve heads seat deeper in cylinder head causing valve stem to protrude further above guide. This allows valve spring to extend beyond length limits assembled height 2.25 inch (57.15 mm) and causes weak spring action. Therefore, up to 1/16 inch of spacers may be used to reduce valve spring to proper height.

(6) Assemble the upper valve spring retainer.

(7) Using a suitable valve spring compressor, compress the valve spring and insert new half collets.

b. Testing with a Vacuum Tester.

(1) The valves and seats must be dry and clean.

(2) Select the correct vacuum cup for size valves to be tested.

(3) Place the vacuum cup over valve head. The O-ring on cup should seat on the flat surface of cylinder head surrounding the valve. Grease can be applied to the O-ring for a better seal.

(4) Turn the hand shutoff valve to the open position; hold the pushbutton to operate the vacuum pump.

(5) Operate the vacuum pump until the hand on vacuum gage stops climbing at 18-25 inches of mercury (60.785-84.425 kPa).

(6) Close the shutoff valve and release the pushbutton to stop the pump.

(7) Time the fall of the gage hand to test the valve seat.

(8) Begin timing as soon as the hand reaches 18 on the dial.

(9) Stop timing when hand reaches eight. If elapsed time is less than 10 seconds, valve seat sealing is unsatisfactory.

(10) Tap the stem end of the valve with a soft faced mallet and retest.

(11) If the valve seat is unsatisfactory, check for leaking connections in the tester; operate the vacuum pump with the suction cup against a clear window glass or any smooth, flat surface; check for fall of the indicator hand indicating a loose connection.

(12) Make sure the valve and seat are not dirty.

(13) Regrind the valve and seat if necessary; however, it is possible to mistake leakage around the valve seat insert for valve seat leakage. If this type of leakage is suspected, apply grease around the outside edge of insert to make a grease seal. Perform a vacuum test and inspect the grease seal for a break indicating air leakage between the wall of counterbore and the valve seat insert. If a leak around the valve seat insert is found, correction is required before continuing with the test.

c. Pipe Plug Installation.

(1) Install all cylinder head pipe plugs and torque to the specifications shown in Table 3-3.

Table 3-3. Pipe Plug Torque Values.

Pipe Plug Size inch (mm)	Minimum lb-ft (N·m)	Maximum lb-ft (N·m)
1/8 (3.175)	15 (20)	20 (27)
1/4 (6.35)	30 (41)	35 (47)
3/8 (9.525)	35 (47)	45 (61)
1/2 (12.70)	45 (61)	55 (75)
3/4 (19.05)	60 (81)	70 (95)
1¼ (31.75)	75 (102)	85 (115)
1½ (38.10)	90 (122)	100 (136)

(2) Use liquid Teflon sealer to prevent leakage.

d. Cylinder Head Vent Holes. A vent hole is located on top of each cylinder head above the air intake port (fig 3-76). The vent hole must be open.

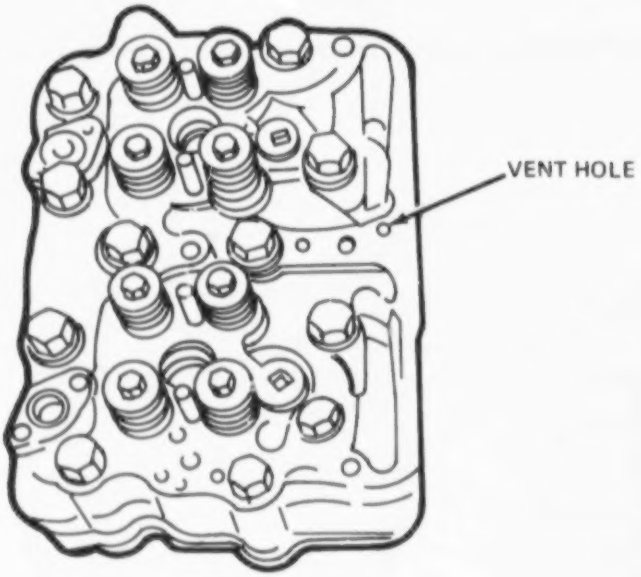


Figure 3-76. Cylinder Head Vent Hole.

Section XII. REPAIR OF ROCKER LEVERS AND HOUSING

3-35. Disassembly.

a. Remove the setscrew securing rocker lever shaft in the housing (fig 3-77).

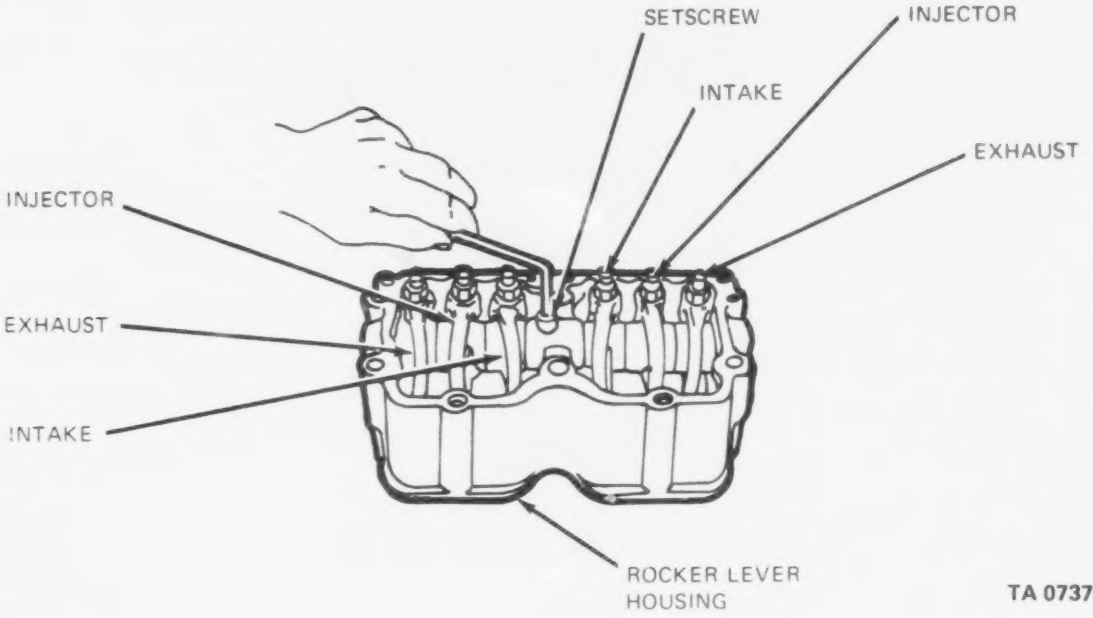

SETSCREW
INJECTOR
INTAKE
EXHAUST
INJECTOR
EXHAUST
INTAKE
ROCKER LEVER HOUSING
TA 073757

Figure 3-77. Removing and Installing a Rocker Lever Shaft Retaining Screw.

b. Drive a sharp-pointed punch through the plug at end of the rocker shaft. Pry out the concave-type plug or press through housing if cup type.

c. Remove the adjusting screws and nuts from all rocker levers.

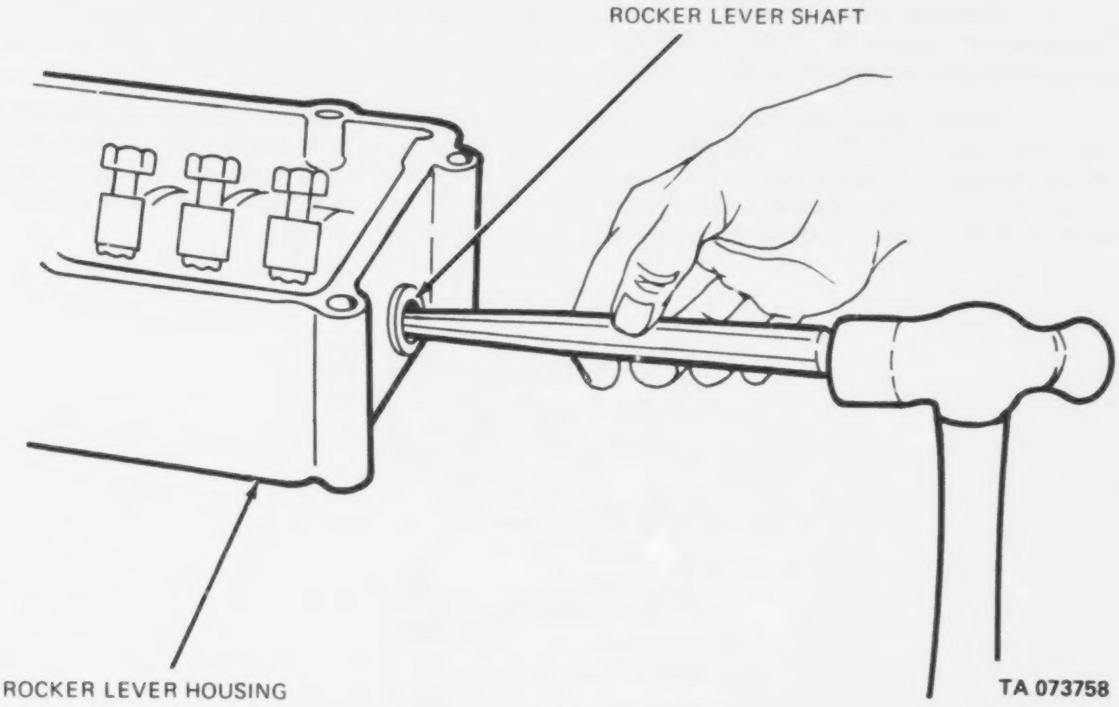


Figure 3-78. Removing the Rocker Lever Shaft.

d. Use a flat drift or punch to drive or press shaft through the housing (fig. 3-78).

e. Tag the rocker levers for position, as removed, to assure correct assembly.

f. Position the shaft in a V-block, not a vise. Insert pin in locking setscrew hole and remove threaded plugs.

3-36. Cleaning.

a. Refer to paragraph 3-2 for cleaning instructions.

b. Remove all gasket material from sealing surfaces.

3-37. Inspection.

a. Inspect all capscrew holes for damaged threads.

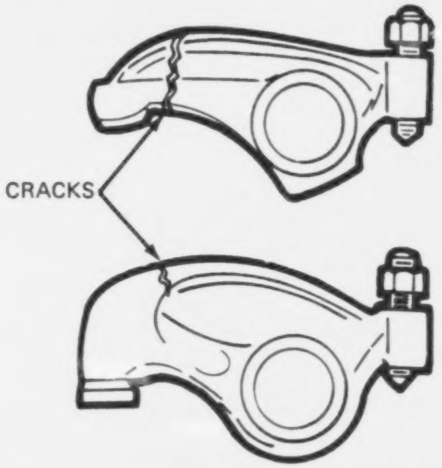
b. Inspect the housing for cracks, breaks, chips, uneven gasket surfaces, distortion, and broken out areas.

c. Visually inspect entrance of the shaft bore for sharp edges, nicks, or burrs. To obtain best results when cup plugs are used, entrance of bore should have a slight radius. Sharp edges can be removed by using 240 grit aluminum oxide paper over a split rod, rotating in an electric drill.

d. Check the breather vent hole and rocker lever oil passage to make sure they are free of dirt or other foreign material.

e. Check all sealing surfaces for damage. Inspect housing rocker lever shaft bore inside diameter. The dimensions should be 1.1238-1.1246 inch (28.545-28.565 mm). If the shaft bore does not meet these dimensions, discard housings and replace.

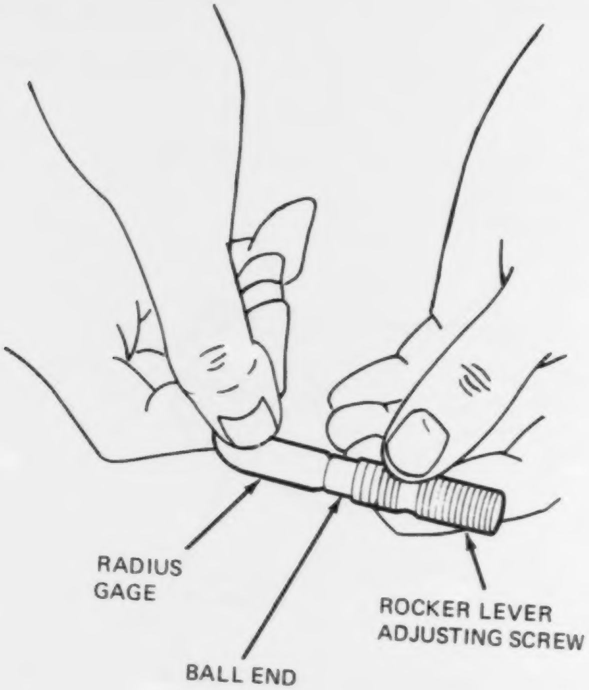
f. Check rocker levers for surface imperfections by magnetic inspections. Apply coil magnetization, amperage at 300-500 with residual Magnaglo. Magnetization with Magnaglo is one of the best means for this inspection, in which the part is magnetized and covered with a fine magnetic powder. In the vicinity of a crack there is a disturbance of the Magnaglo which gathers in the crack and effectively marks it. Refer to figure 3-79 for the most likely areas for crack indication.



TA 073759

Figure 3-79. Magnetic Inspection Crack Indication.

g. Inspect the ball end of rocker lever adjusting screw for being a true sphere. Using a ¼ inch radius gage, check the ball end of the rocker lever adjusting screw for a true conformity periphery (fig 3-80). Replace if flat at the bottom or there is evidence of scratching or galling.



TA 073760

Figure 3-80. Checking the Rocker Lever Adjusting Screw Ball End.

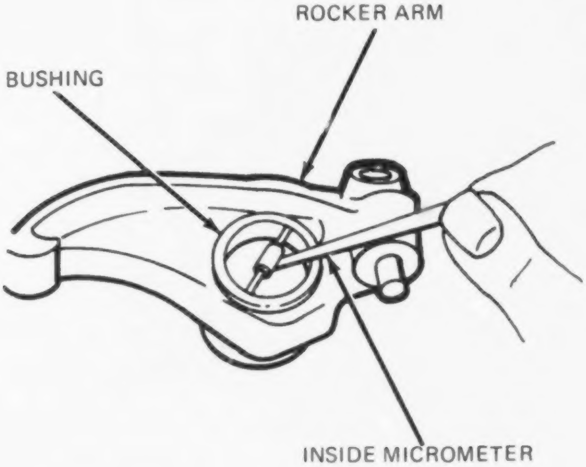
h. Check the thread condition on all screws and in levers. Check closely for thread distortion at the assembly position of the locknut. Screws must run freely through the levers.

i. Examine the injector rocker lever sockets for a true fit on the injector links. Check the sockets with a radius gage or by observation of a small protrusion at the bottom of the socket. Remove and discard damaged or badly worn injector rocker lever sockets by drilling a small hole in lever above the socket. After the socket is removed, weld the hole closed or install and stake a plug in the hole.

j. Check the rocker lever bushings for scratches, pitting, scoring, broken out sections, and excessive wear.

k. Check rocker lever bushing inside diameter using inside micrometers (fig 3-81). Refer to the following dimensions for rocker lever bushing specifications.

(1)	New Minimum	1.1245 inch (28.562 mm)
(2)	New Maximum	1.1275 inch (28.639 mm)
(3)	Wear Limit	1.1286 inch (28.664 mm)



TA 073761

Figure 3-81. Checking the Rocker Lever Bushing for Wear.

l. Check the intake and exhaust rocker lever-to-crosshead contact surfaces. If worn or damaged, grind to original contour or replace with a new rocker lever.

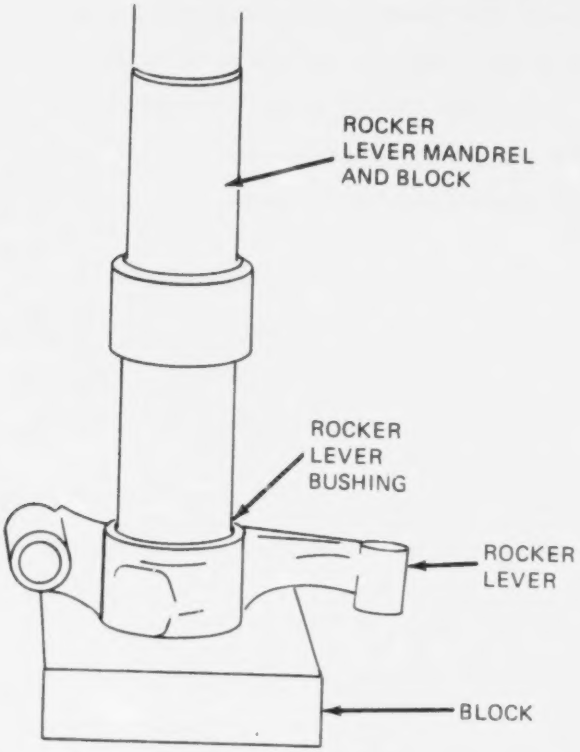
m. Check the rocker lever shaft for wearing or scoring. If the shaft has ridges or shoulders due to rocker lever action on shaft, replace with a new rocker lever shaft. Refer to the following dimensions for the rocker lever shaft specifications:

(1)	New Minimum	1.1230 inch (28.52 mm)
(2)	New Maximum	1.1240 inch (28.55 mm)
(3)	Wear Limit	1.1220 inch (28.50 mm)

3-38. Repair.

a. Using a mandrel and block, press out the rocker lever bushing.

b. Press a new rocker lever bushing into the rocker lever using mandrel and block (fig 3-82).


ROCKER LEVER MANDREL AND BLOCK
ROCKER LEVER BUSHING
ROCKER LEVER
BLOCK

TA 073762

Figure 3-82. Removing and Installing the Rocker Lever Bushing.

CAUTION

On injector and exhaust valve rocker levers, install the bushings so the oil holes to the crosshead nose or the injector link and adjusting screw are open for oil flow. On the intake valve rocker levers with the oil drilling to the crosshead nose end, install the bushing so nose hole is closed and the slot hole is in line with the adjusting screw oil hole. Do not bore steel bushings.

3-39. Assembly.

a. The rocker lever assembly is lubricated through oil holes in the shaft and rocker lever housing which index with the oil pipe.

b. Install the rocker lever socket in the injector rocker lever.

c. Install the adjusting screws and locknuts in the rocker levers.

d. Install cup-type plugs in the rocker lever shaft using plug driver.

e. Coat the rocker lever shaft with clean lubricating oil.

f. Start the shaft into the housing. Install the levers on the shaft as the shaft is pushed through the housing.

g. Refer to figure 3-77 for correct positioning of the levers.

h. Position the exhaust, injector, and intake levers in the housing (fig 3-77).

i. Install the intake, injector, and exhaust levers (fig 3-77).

j. Check all rocker levers for freedom of movement on the shaft. This will prevent galling of the shafts and bushings.

k. Aline the shaft in the housing and install and tighten shaft setscrew.

l. Install new cap plugs at each end of the housing using plug driving mandrel.

Section XIII. REPAIR OF PUSH TUBES

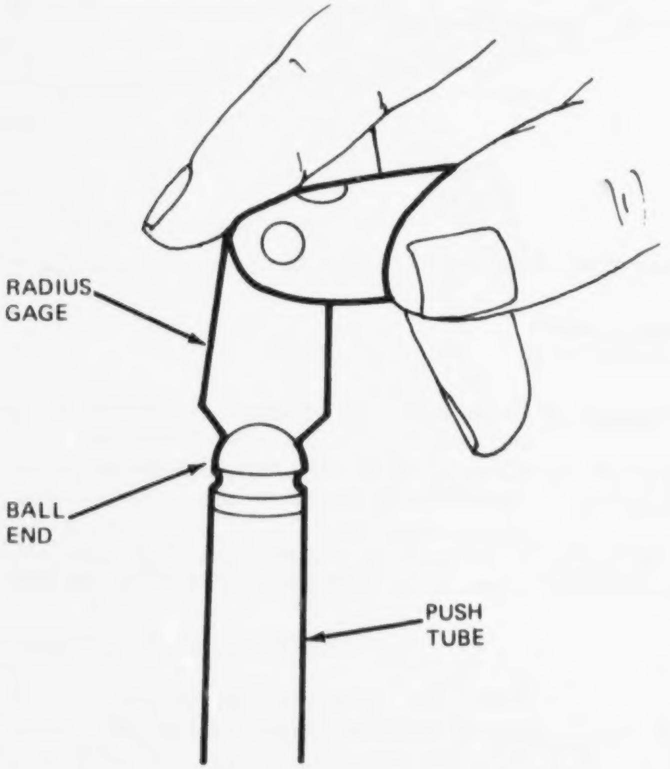
3-40. Cleaning. Refer to paragraph 3-2 for the cleaning instructions.

NOTE

Each cylinder has exhaust, injector, and intake push tubes. The injector push tube is the largest and fits in the middle socket. Intake and exhaust push tubes are identical.

3-41. Inspection.

a. Check the injector and valve push tube ball end for wear using a radius gage (fig 3-83).

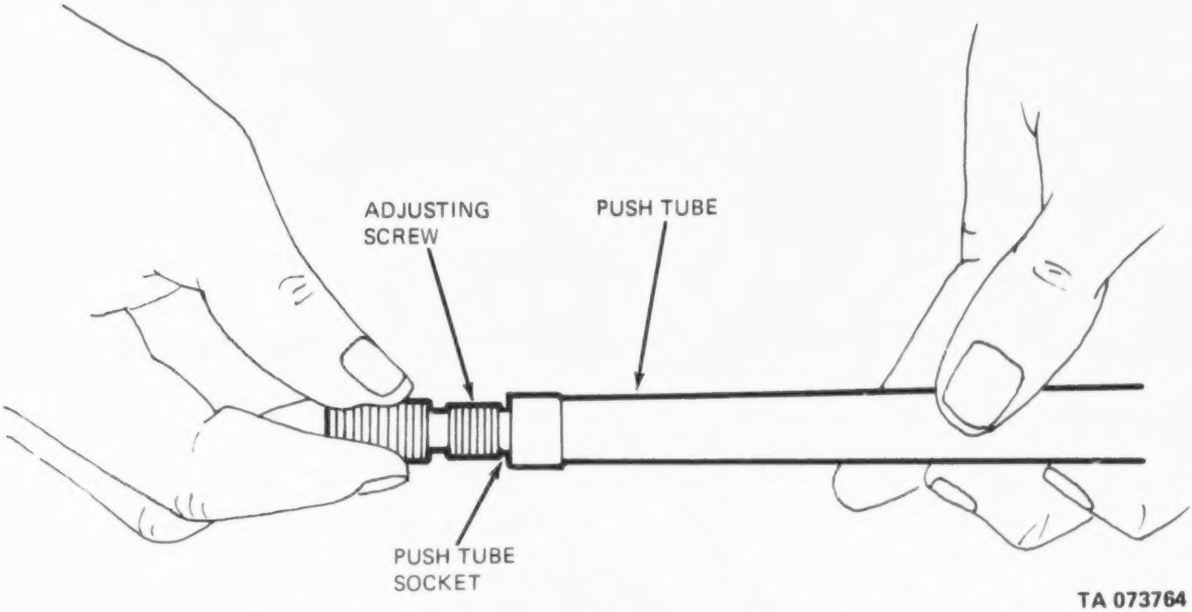


TA 073763

Figure 3-83. Checking the Push Tube Ball End With a Radius Gage.

b. Check the ball end of valve and injector push tubes for the proper diameter. The diameter must be 0.623-0.625 inch (15.82-15.88 mm).

c. Check socket of push tube with ball end of a new rocker lever adjusting screw, figure 3-84; or with a 1/2 inch check ball which should "blue in" 80 percent of seat area.



TA 073764

Figure 3-84. Checking the Push Tube Socket With an Adjusting Screw.

NOTE

Extreme wear on either end of the push tube will result in loss of lubricating oil pressure and may interfere with correct injector or valve adjustment.

d. Check the push tubes for being bent or out-of-round. Push tubes must not be out-of-round more than 0.025 inch (0.64 mm) when located in the centers of socket and ball.

NOTE

Push tubes that are bent have usually had the adjusting screws over-torqued.

CAUTION

Do not install push tubes with worn balls in new cam follower sockets.

e. Replace any push tubes which have begun to fill with lubricating oil.

Section XIV REPAIR OF CAM FOLLOWERS

3-42. Disassembly.

a. Remove the gaskets from the cam follower casting surface, if not previously removed.

b. Remove the lockscrews securing the shafts in the housing (fig 3-85).

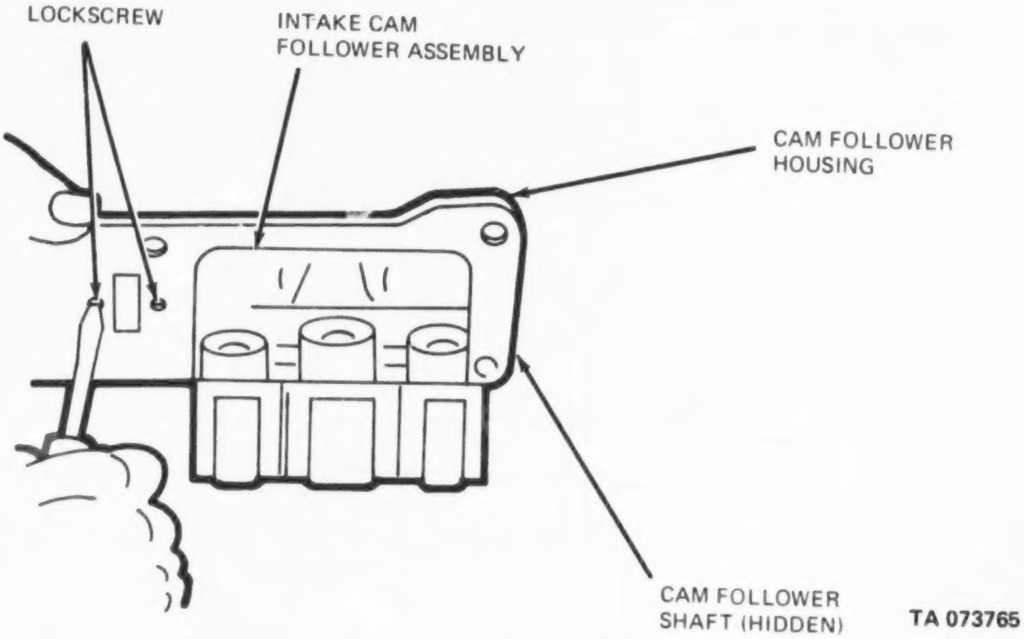

LOCKSCREW
INTAKE CAM FOLLOWER ASSEMBLY
CAM FOLLOWER HOUSING
CAM FOLLOWER SHAFT (HIDDEN)
TA 073765

Figure 3-85. Removing and Installing the Cam Follower Shaft Lockscrews.

c. Remove the cup plug by using a sharp pointed punch. Punch a hole in the center of the plug. Tap one side of the plug to force the other side of the plug out of the hole. Using a suitable mandrel, press both shafts out the opposite end forcing the cup plug out of the hole.

d. Remove the cam follower levers from the housing.

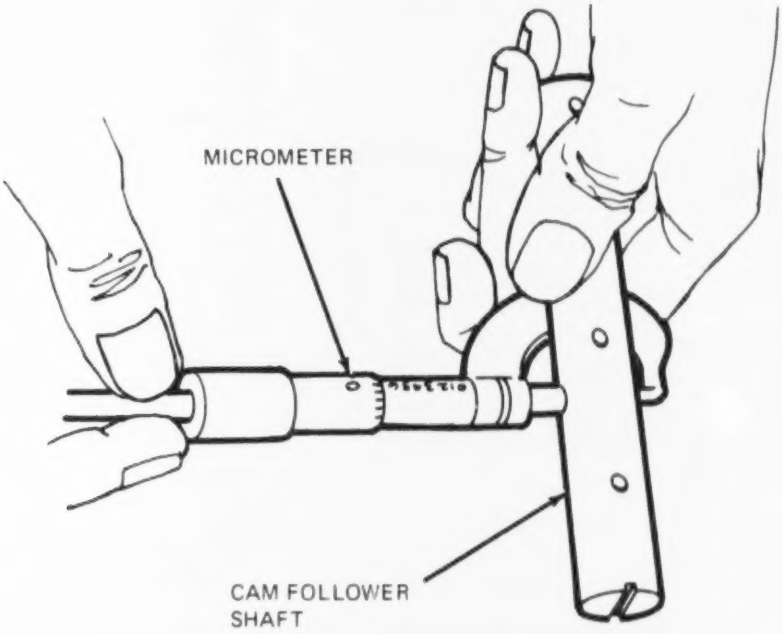
3-43. Cleaning. Refer to para 3-2 for the cleaning instructions.

NOTE

Clean the small oil passages in levers.

3-44. Inspection.

a. Measure the outside of the shafts using a micrometer (fig 3-86). Shaft dimensions should be 0.7485-0.7490 inch (19.012-19.02 mm). Replace shafts if worn smaller than 0.7480 inch (19.00 mm).



TA 073766

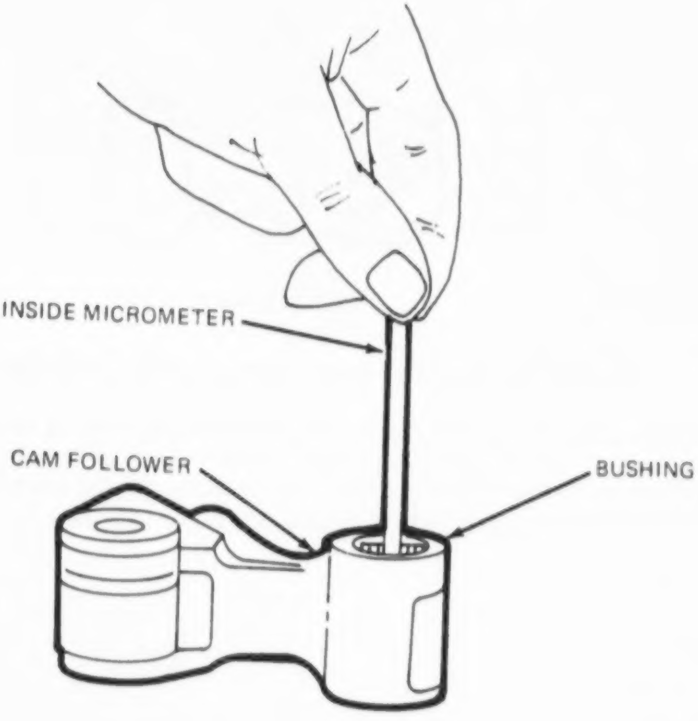
Figure 3-86. Measuring the Cam Follower Shaft.

b. Check the cam follower shafts very carefully around the lockscrew end to make sure the grooves are clean.

c. Check the shafts for cracks, breaks, galling surface imperfections, or broken out areas.

d. Inspect the cam follower rocker housing for cracks, breaks, gasket surface imperfections, broken out sections, distortion, and any other defects that would make the housing unserviceable.

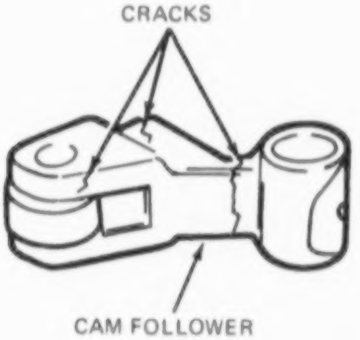
e. Check the cam follower bushings for scratches, pitting, and scoring. Check the bushing inside diameter using inside micrometer (fig 3-87). Dimensions should be 0.7501-0.7511 inch (19.053-19.078 mm). If the bushings are worn larger than 0.752 inch (19.10 mm), replace the bushing.


INSIDE MICROMETER
CAM FOLLOWER
BUSHING

TA 073767

Figure 3-87. Measuring the Cam Follower Bushing.

f. Inspect each cam follower for surface imperfections by magnetic inspection. Apply coil magnetization, amperage at 300-500 with residual Magnaglo. Magnetization with Magnaglo is one of the best means for this inspection, in which the part is magnetized and covered with a fine magnetic powder. In the vicinity of the crack there is a disturbance of the Magnaglo which gathers in the crack and effectively marks it. Refer to figure 3-88 for most likely areas.

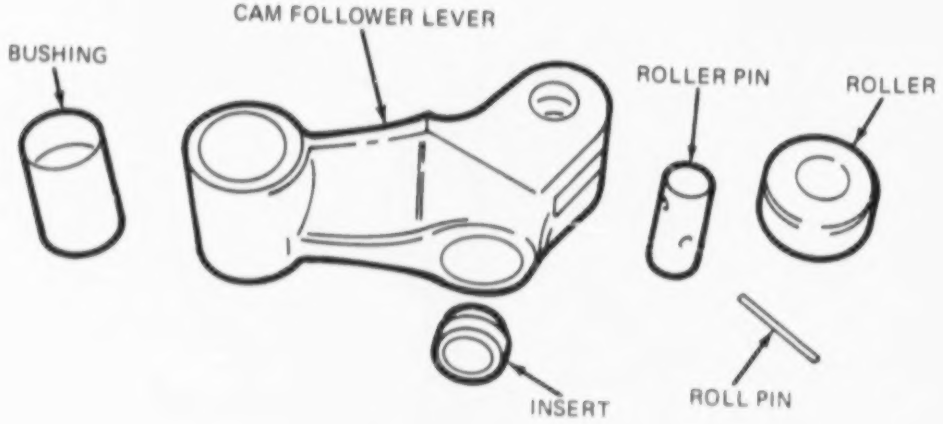


TA 073768

Figure 3-88. Magnetic Crack Detection Check of the Cam Follower.

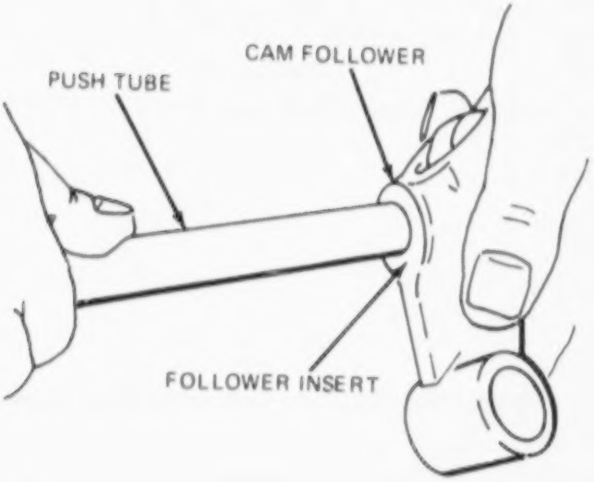
g. Inspect the edges of cup plug holes in the cam follower housing for sharp edges and nicks. If damage during removal of cup plug is evident, use a 240 grit aluminum oxide paper and clean the hole. Chamfer the entrance of this hole to form a slight radius and break the sharp edges to aid the installation of the cup plug without damaging the sealing surface.

h. Inspect the cam follower levers insert (fig 3-89) for scoring, galling, pitting, and excessive wear. Check the insert using a new push tube ball or 0.625 inch (15.88 mm) checking ball and prussian blue (fig. 3-90). The insert must "blue in" 80 percent blue. Replace the insert if the match is in any way questionable or doubtful.


CAM FOLLOWER LEVER
BUSHING
ROLLER PIN
ROLLER
INSERT
ROLL PIN

TA 073769

Figure 3-89. Cam Follower – Exploded View.

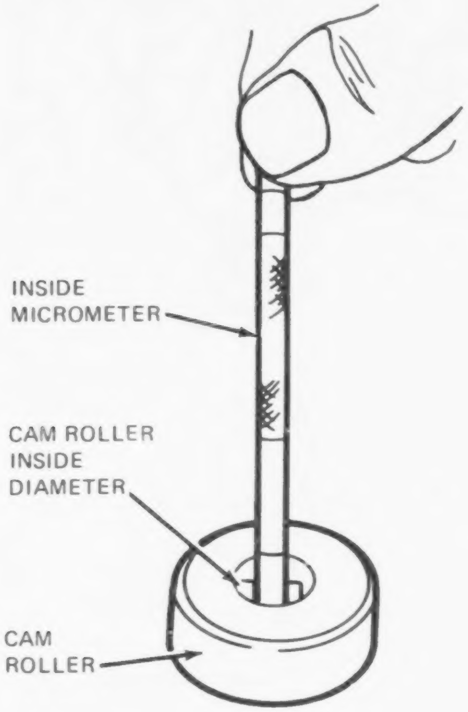

CAM FOLLOWER
PUSH TUBE
FOLLOWER INSERT

TA 073770

Figure 3-90. Checking the Cam Follower Insert With a Push Tube.

i. Remove the cam roller pins (fig 3-89) and rollers from cam follower levers. Check for cracks, breaks, and any other unserviceable condition.

j. Using a small bore gage set at 0.0002 inch (0.005 mm) above worn limit, check cam roller bore inside diameter for being out-of-round and for excessive wear (fig 3-91). Inside diameter new dimensions for the injector cam rollers are 0.703-0.704 inch (17.86-17.88 mm). Worn replacement limit is 0.705 inch (17.91 mm). Valve cam roller new dimensions are 0.5005-0.5015 inch (12.773-12.708 mm). Worn replacement limit is 0.5030 inch (12.78 mm).



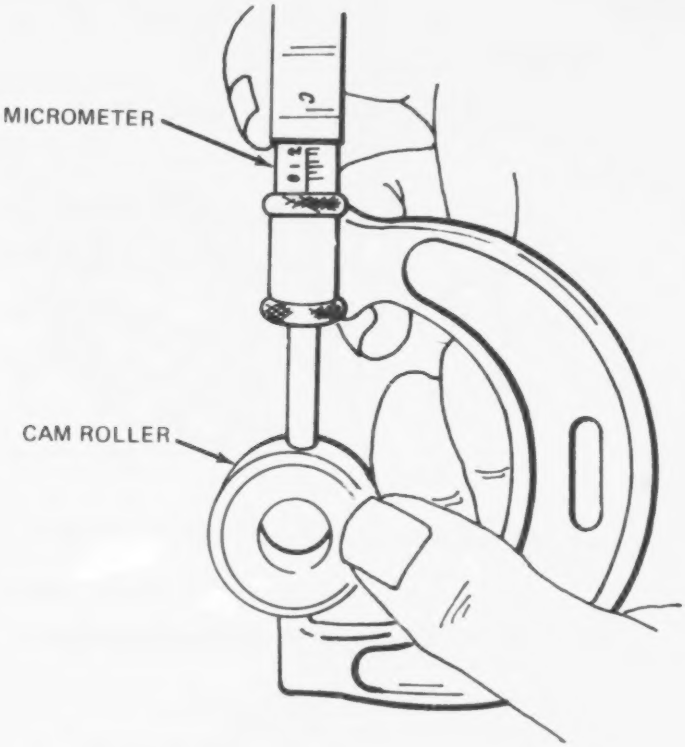
TA 073771

Figure 3-91. Measuring Cam Roller Inside Diameter.

NOTE

Cam roller dimensions are critical and dimensions must be closely adhered to.

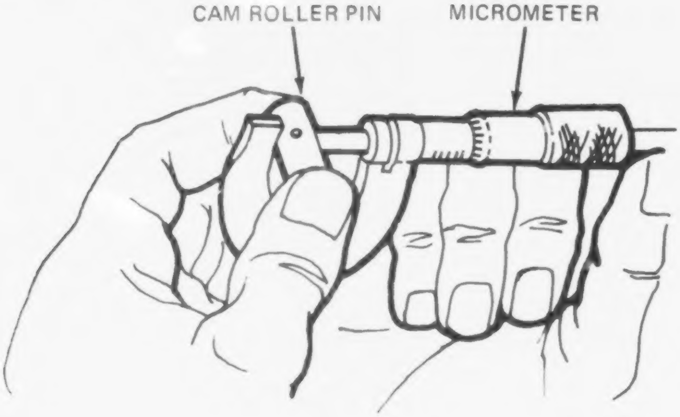
k. With a micrometer, check the outside diameter of the cam rollers (fig. 3-92). Injector cam roller new dimensions are 1.2495-1.2505 inch (31.73-31.76 mm). Valve cam roller new dimensions are 1.2495-1.2505 inch (31.73-31.76 mm). Wear limit for all cam rollers is 1.2485 inch (31.71 mm).



TA 073772

Figure 3-92. Measuring Cam Roller Outside Diameter.

l. On all cam rollers the inside diameter must be concentric with the outside diameter within 0.0020 inch (0.05 mm). Sides must be square to bore and parallel to each other within 0.0040 inch (0.10 mm). Inspect cam roller pins (fig. 3-93). Valve cam roller pin dimensions are 0.4995-0.500 inch (12.687-12.70 mm). Wear limit is 0.497 inch (12.62 mm). Injector cam roller pin dimensions are 0.695-0.700 inch (17.767-17.780 mm). Wear limit is 0.697 inch (17.70 mm). Replace any pin not meeting these dimensions.



TA 073773

Figure 3-93. Measuring the Cam Roller Pin.

NOTE

If the rollers were scored or galled, make a careful inspection on all camshaft lobes for wear.

3-45. Repair.

a. Remove the cam follower bushing using a suitable remover (fig 3-94).

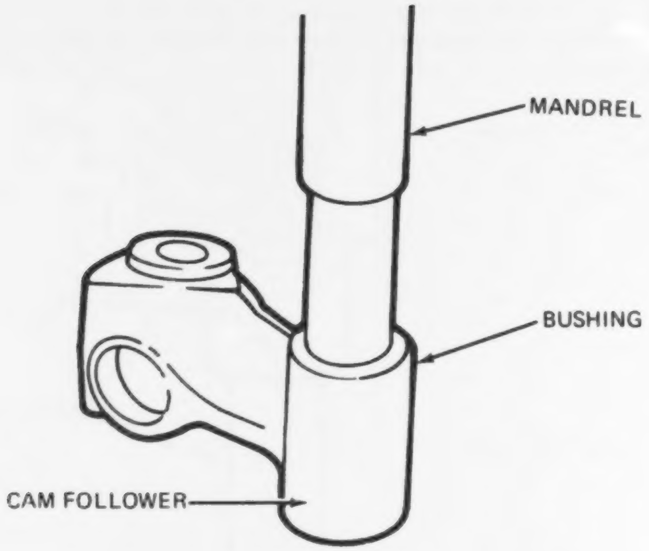


Figure 3-94. Removing the Cam Follower Bushing.

b. Blow out the oil passages with compressed air.

c. Install new cam follower bushing using a suitable driver.

NOTE

Be sure to aline the oil holes in the bushing with the holes in cam follower.

d. Chamfer each end of the bushing with a 60° angle cutter in a slow-speed drill press.

e. Fill lubricating oil holes in bushings with semi-soft soap to prevent chips from entering oil passages during boring operations.

f. Bore bushings to 0.7501-0.7511 inch (19.053-19.078 mm).

g. Check bored bushings with an inside micrometer or gage for the proper dimensions.

h. Blow soap from oil holes and clean lever in drycleaning solvent. Blow the lever dry with compressed air.

3-46. Assembly.

a. Install the new lever insert (fig 3-89) and make sure insert is securely seated in the lever.

b. Install cam rollers with 0.006 inch (0.15 mm) feeler gage beneath roller and next to the lever as a support. Press the pins through the rollers and levers, then remove the feeler gage (fig. 3-95). Secure the cam roller pins with roll pins.

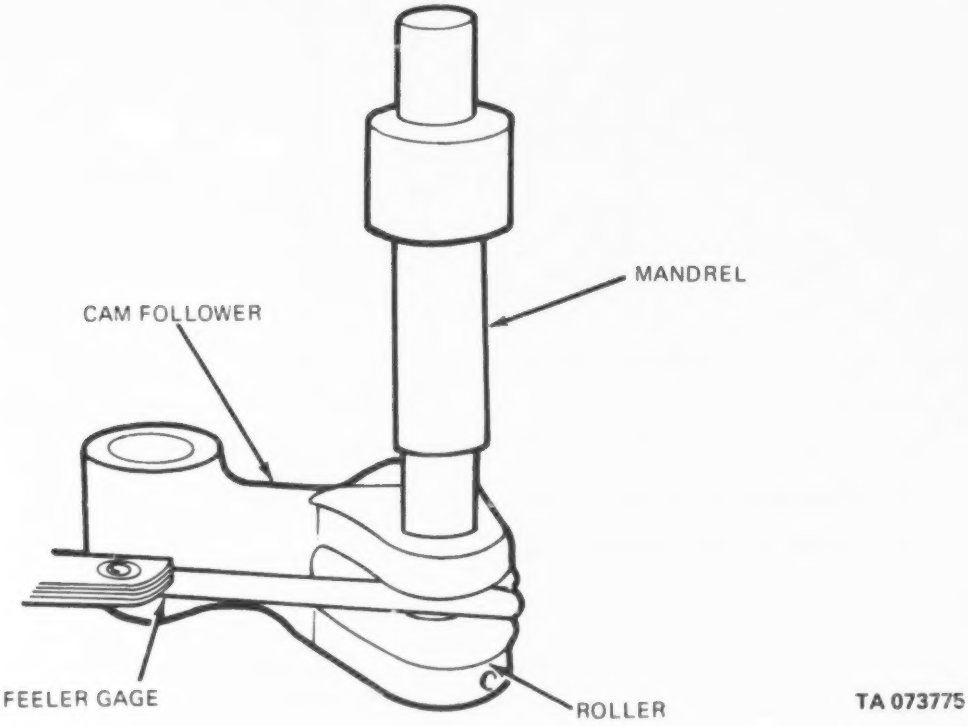

MANDREL
CAM FOLLOWER
FEELER GAGE
ROLLER
TA 073775

Figure 3-95. Installing the Cam Follower Roller Pin.

c. Assemble the levers and shafts in the housing. Make sure the injector lever is in the center position of each housing (fig 3-96).

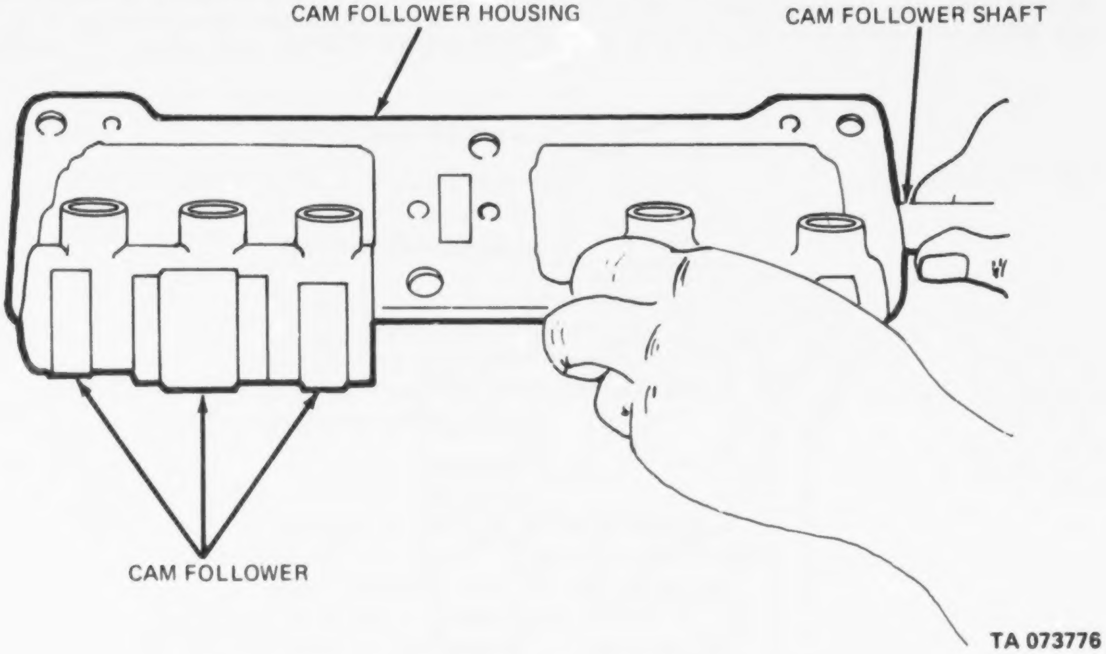

CAM FOLLOWER HOUSING
CAM FOLLOWER SHAFT
CAM FOLLOWER
TA 073776

Figure 3-96. Assembling the Cam Follower Assembly.

NOTE

Cam rocker levers must be installed in the housing with the push tube sockets and housing dowel pin holes in the topside position.

d. Install a dummy screw in the shaft.

NOTE

A dummy screw is used at this point to prevent lockscrew breakage. Screws have a tendency to break due to the close shaft-to-housing fit, causing the plug to act as a hydraulic ram when driven in place.

e. Install new cup plugs at each end of the housing. Use number 3 Permatex sealant and lightly coat bore in each end of the housing before the plugs are pressed in. Use a suitable plug driving mandrel to press in the new cup plug until it is flush to within 0.010 inch (0.25 mm) below the edge of the hole (fig. 3-97).

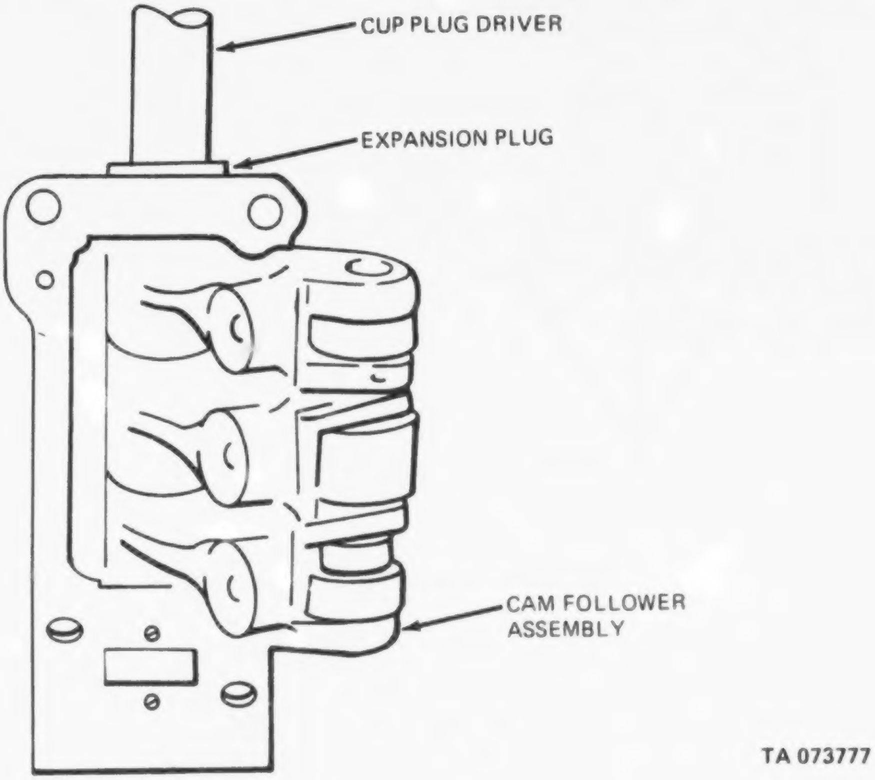

CUP PLUG DRIVER
EXPANSION PLUG
CAM FOLLOWER ASSEMBLY
TA 073777

Figure 3-97. Installing the Cup Plugs.

f. Remove the dummy screw and install the shaft lock screws.

Section XV REPAIR OF VIBRATION DAMPER

3-47. Cleaning. The viscous type vibration damper must be cleaned of rust, dirt and grease with dry-cleaning solvent.

3-48. Inspection.

CAUTION

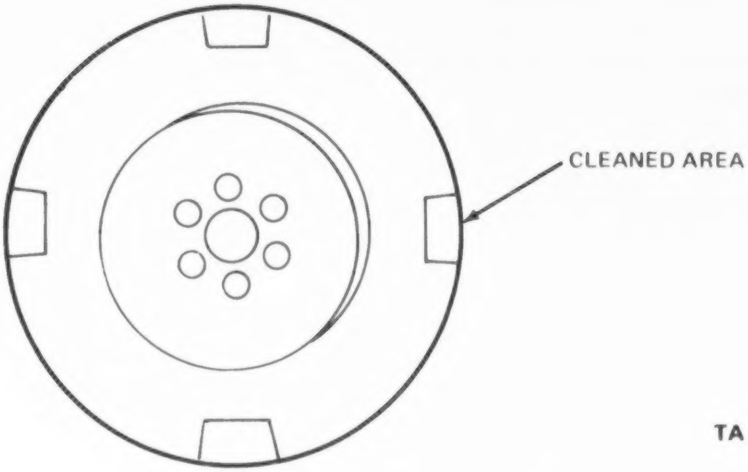
Coarse emery cloth or scraper should not be used as they may remove excess material from the surfaces of the damper. Use only dry-cleaning solvent and fine (240 grit) emery cloth.

NOTE

Dimensional analysis of a large number of failed viscous vibration dampers has revealed that a viscous damper's condition can be accurately evaluated by measuring its thickness. This measurement will expose any deformation or raising of the viscous damper's front cover plate. Front cover plate movement is caused by the gellation and resulting expansion of the silicon fluid contained in the damper. This fluid change of state is the result of continuous high frequency shearing of the fluid between the inner ring and the damper housing under normal operating conditions. Consequently, the silicon fluid gels and expands, distorting the front cover plate or forcing it outward. These symptoms indicate that the internal members of the damper are inoperative and the damper is no longer effective in reducing torsional vibrations. As an inoperative damper will most likely lead to major engine or driveline failures, it must be replaced.

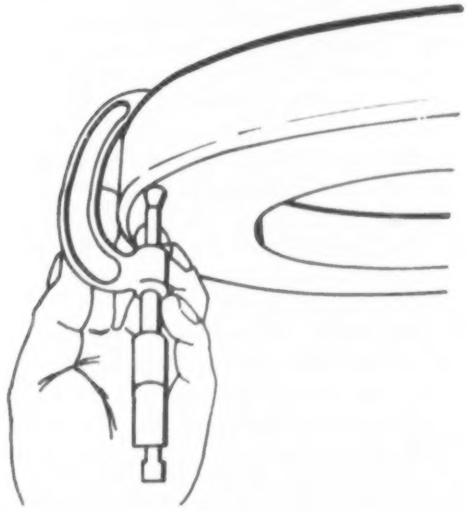
a. Remove the paint and accumulated dirt and grime from both the front and rear surfaces of the damper in four equally spaced areas, as shown in figure 3-98, (avoid areas with stamped lettering). This will allow for precise measurement of the damper's thickness with a micrometer.

b. Measure and record the thickness of the damper at each of the four equally spaced areas approximately 0.125 inch (3.18 mm) from the outside edge of the front cover plate as shown in figure 3-99.



TA 073797

Figure 3-98. Damper Prepared for Measurement.



TA 073778

Figure 3-99. Measuring the Vibration Damper.

Replace the damper if the variation in the four thickness dimensions exceed 0.010 inch (0.25 mm) or if any of the thickness dimensions exceeds 1.663 inches (42.24 mm).

c. Viscous vibration dampers should be checked under the following conditions:

(1) At 150,000 miles (241,500 km).

(2) At any time the damper is removed from the engine.

(3) At any time the engine experiences the following problems:

(a) Gear train failure

(b) Accessory drive shaft failure

(c) Crankshaft failure

(d) Damper mounting capscrew failure

(e) Flywheel mounting capscrews failure

NOTE

Viscous vibration dampers should be replaced at our recommended change interval of 300,000 miles (483,000 km) regardless of condition. Gellation of the damper's silicon fluid occurs after extended service because of the high shear rates and resulting high temperatures imposed on the fluid during normal damper operation and, if the damper has not failed at this time, its failure is imminent.

Section XVI. REPAIR OF FLYWHEEL

3-49. Flywheel.

a. Cleaning and Inspection.

(1) Refer to paragraph 3-2 for cleaning instructions.

(2) Inspect the ring gear for broken or cracked teeth. Replace the ring gear if defective.

b. Repair.

(1) Drive the ring gear from the flywheel with blunt chisel.

CAUTION

Do not use a cutting torch. Overheating to temperatures above 660°F (335°C) will soften the gear.

(2) If an oven with a heat control is not available, heat replacement gear with a heating torch from the inside diameter so heat travels outward to the teeth. Heat to 600°F (301°C).

(3) Place the ring gear on the flywheel and quickly drive it onto the flywheel until the gear is firmly seated.

Section XVII. REPAIR OF REAR COVER

3-50. Rear Cover. The rear cover is a unit subject to replacement of the seals only. Damaged housings require replacement by a new assembly.

Section XVIII. REPAIR OF ROCKER ARM HOUSING COVERS

3-51. Rocker Arm Housing Covers.

a. Cleaning.

(1) Remove all gasket material from the sealing edge of the cover.

(2) Refer to paragraph 3-2 for additional cleaning instructions.

b. Inspection. Inspect the cover for cracks, dents, and distorted sealing area. Inspect for cracks around all capscrew holes.

c. Repair. Replace the cover if found defective during inspection (*b.*, above).

Section XIX. REPAIR OF OIL PAN

3-52. Oil Pan.

a. Disassembly. Remove the oil pump-to-pan oil line adapter.

NOTE

If necessary, remove engine oil heater. Refer to TM 9-2320-273-34. For engine oil heater thermostat removal, refer to TM 9-2320-273-20.

b. Cleaning.

(1) Remove all gasket material from the oil pan mating surfaces.

(2) Steam clean the pan and all mounting parts.

c. Inspection.

(1) Inspect the oil pan for cracks or, if a leak is suspected, check using dye penetrant.

(a) Spray the suspected area with dye penetrant.

(b) Allow the penetrant to dry for fifteen minutes. Do not "force dry".

(c) Spray the area with dye developer.

(d) Check for crack indications.

(2) Check threaded holes for damaged threads.

d. Repair.

(1) Repair damaged threaded holes with a used tap.

(2) Repair small cracks in the pan by welding.

e. Assembly.

(1) Using new gaskets, install the oil pump-to-pan oil line adapter.

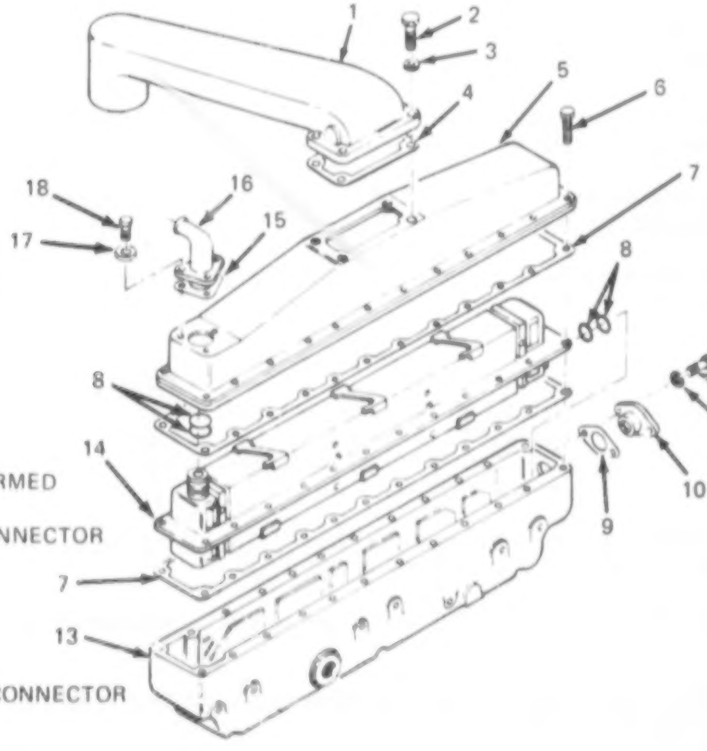
(2) Install the plugs and the by-pass oil fitler fitting, if removed.

Section XX. REPAIR OF AFTERCOOLER

3-53. Aftercooler.

a. Disassembly.

(1) Remove three capscrews (18, fig. 3-100) and flatwashers (17) that secure the water connection (16) to the cooler cover (5) and lift off the connection. Remove gasket (15) from the cooler cover.



LEGEND

1. AIR CROSSOVER
2. CAPSCREW
3. LOCKWASHER
4. GASKET
5. COVER
6. CAPSCREW
7. GASKET
8. PACKING, PREFORMED
9. GASKET
10. WATER INLET CONNECTOR
11. CAPSCREW
12. FLATWASHER
13. HOUSING
14. CORE
15. GASKET
16. WATER OUTLET CONNECTOR
17. FLATWASHER
18. CAPSCREW

TA 073798

Figure 3-100. Disassemble & Assemble Aftercooler Assembly.

(2) Remove 24 capscrews (6) that secure the cooler cover (5) to the cooler housing (13). Remove cooler cover (5), upper gasket (7), core element (14) and lower gasket (7) from the cooler housing.

(3) Remove preformed packing (8) from water inlet and outlet connections on core element.

(4) Remove four capscrews (2) and lockwashers (3) that secure the air crossover (1) to the cooler cover. Remove gasket (4) from the cooler cover.

(5) Remove two capscrews (11) and flatwashers (12) that secure the water inlet connection (10) to the cooler housing (13). Remove water inlet connection (10) and gasket (9).

NOTE

It may require some force to separate the components.

b. Inspection and Repair.

(1) Inspect the cooler housing, cover and sealing surfaces for breaks and distortion.

(2) Replace all damaged parts.

c. Assembly and Testing.

(1) Lubricate the preformed packings (8) with clean lubricating oil (OE/HDO). Install the preformed packing on the water inlet and outlet connections at the cooler core element.

(2) Place the lower gasket (7) on the cooler housing and position the core element (14) into the housing. Install gasket (9) and water inlet connection (10) through the housing and finger-tighten the capscrews (11) and flatwashers (12).

(3) Position the air crossover gasket (4) on the cooler cover (5). Install the air crossover (1) and finger-tighten the capscrews (2) and lockwashers (3).

(4) Position the upper gasket (7) on the core element flange and install the cover (5) and finger-tighten all the capscrews (6).

(5) Install the water outlet connection (16) and gasket (15) and finger-tighten capscrews (18) and flatwashers (17).

NOTE

At this point, check the water inlet and outlet connections to be centered and make sure that all the gaskets are properly alined.

(6) Starting at the center of aftercooler housing and alternating to either side of the center, tighten the capscrews to 15-20 lb-ft (20-27 N·m) torque.

(7) Tighten the water inlet and outlet flange mounting capscrews to 27-32 lb-ft (37-43 N·m) torque.

(8) Attach a pressure test apparatus to the assembly. When pressurized, the assembly must maintain 40 psi (226 Kpa) for one minute.

Section XXI. REPAIR OF EXHAUST MANIFOLD

3-54. Exhaust Manifold.

a. Cleaning and Inspection.

(1) Clean the manifold with steam.

(2) Inspect the manifold for cracks and distortion.

b. Repair. Replace defective parts with a new part.

Section XXII. REPAIR OF TURBOCHARGER

The exterior of turbocharger should be cleaned before disassembly. Mark the compressor casing, diffuser plate, turbine casing, bearing housing and clamps to facilitate assembly in the same position.

3-55. Disassembly.

a. Remove the elbows from the lubricating oil inlet and outlet ports.

b. Remove the self-locking nut from compressor end of rotor shaft.

c. Remove the self-locking nuts, flatwashers and bolts securing the V-clamp to the turbocharger. Lift off the V-clamps; discard the self-locking nut, flatwashers and bolts.

d. Screw a steel 3/4-inch NPT nipple 6 inches long into the oil outlet port. Support the turbocharger by the nipple in a vise. Using puller, pull the compressor housing, oil seal, diffuser plate and compressor wheel from the bearing housing (fig. 3-101). If difficulty in pulling the compressor housing from the bearing housing is experienced, a slide hammer puller arrangement may be used.

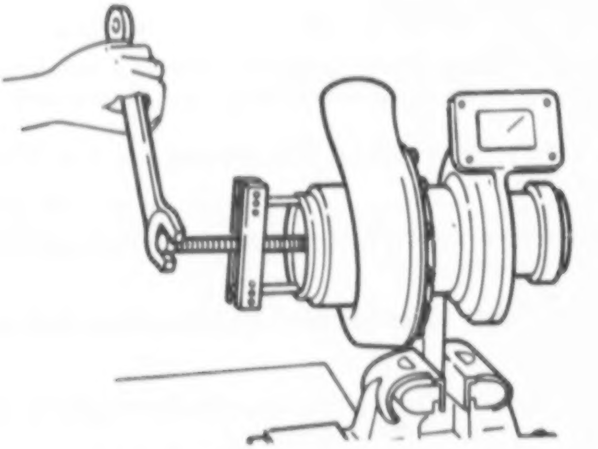


Figure 3-101. Removing the Compressor Casing, Oil Seal, Diffuser Plate and Compressor Wheel From Bearing Housing.

e. Remove the capscrews and lockwashers securing the compressor housing to the diffuser plate.

f. Tap gently to loosen and remove the diffuser plate from the compressor housing. Remove and discard the sealing ring. Lift out the compressor wheel.

g. Remove the Teflon pad and floating bearing from the rotor shaft. Remove the O-ring from the bearing housing. Discard the O-ring and Teflon pad.

h. Position a suitable bearing support over the bearing housing and against the turbine housing. Place the assembly on a press. Press the rotor assembly and bearing housing from the turbine housing.

i. Invert the bearing housing and gently tap the turbine shaft on the workbench to remove the turbine wheel and shaft assembly. Lift out the turbine wheel and shaft assembly.

j. Remove the heatshield and insulation pad from the bearing housing.

k. Remove the sealing sleeve assembly from the oil seal/diffuser plate. Discard the seal assembly.

l. Remove the sealing rings from the grooves in the rotor shaft. Discard the sealing rings.

3-56. Cleaning.

Turbocharger parts accumulate hard glazed carbon deposits that are difficult to remove with ordinary solvents. The cleaner used must be capable of removing these stubborn deposits without attacking the metal.

a. Place all parts in a divided wire basket so the parts will not be damaged through contact. Do not pile in the basket. Be careful to avoid damage to all precision-ground surfaces.

CAUTION

Never use a caustic solution or any type
solvent that may attack aluminum,
Stellite or Ni-Resist alloys.

b. Immerse the parts in a suitable solvent.

c. Allow the parts to soak as long as needed to remove carbon. A soft bristle brush may be used, if necessary, to remove heavy deposits. Never use wire or other type brushes with stiff bristles.

d. Flush out the oil passages in the bearing housing, from drain end, to remove dirt loosened by soaking.

(1) Leave parts submerged in solvent for a minimum of 12 hours, preferably 24 hours. Agitate the solvent for maximum cleaning.

(2) After completion of Step *(1)*, pump solvent through passage again to flush out any loose particles.

e. Remove the parts from the tank. Drain and steam clean thoroughly to remove all carbon and grease. Apply steam liberally to oil passages in bearing housing.

f. Blow off the excess water and dry with moisture-free compressed air.

g. Place the parts carefully in clean basket to avoid damage and dirt.

3-57. Inspection of Critical Components.

a. Heatshield. Inspect the heatshield for cracks, distortion and burned condition; discard, if damaged. Cracks on the bore of the heatshield less than 1/2 inch (12.7 mm) long are not cause for replacement.

b. Oil Seal Plate/Diffuser Plate. Inspect the oil seal/diffuser plate for cracks, burrs and distortion; discard, if damaged.

c. Compressor Wheel. The compressor wheel cannot be reused if the vanes are cracked, broken, or have rubbed the compressor casing. Check for cracks with dye penetrant. If a new compressor wheel is required, the rotor assembly does not have to be balanced.

d. Turbine Wheel and Shaft. Inspect the sealing ring grooves for extensive damage. Small grooves or marks are acceptable but deep grooves are not. Smooth with a polishing cloth before reusing. Check the turbine thrust shoulder for scoring. Check for turbine wheel cracks with dye penetrant. Cracks in the turbine wheel render the assembly unfit for further use.

e. Floating Bearing. Check bearing length for wear, chips and cracks. If dimension is worn less than limits shown in table 3-4, the bearing must be discarded.

Table 3-4. Floating Bearing Dimensions.

	MIN INCH	(MM)	MAX INCH	(MM)
Floating Bearing Length	3.077	(78.16)	3.079	(78.21)
Floating Bearing Flange Thickness	0.136	(3.45)	0.143	(3.63)
Floating Bearing Flange Width	1.850	(46.99)	1.960	(49.78)
Floating Bearing ID	0.7520	(19.101)	0.7525	(19.114)
Floating Bearing OD	1.272	(32.31)	1.273	(32.33)

f. Compressor Casing/Collector Housing. If slight scratches or nicks are present, they may be smoothed out with a very fine polishing cloth and the compressor casing may be reused. Discard if cracked or distorted.

g. Miscellaneous. The V-clamps may be cleaned and reused unless they are damaged.

3-58. Assembly.

CAUTION

All parts and work area must be free of grease, oil and dirt to keep any abrasives out of the turbocharger during assembly and to obtain the correct dimensional stack-up of the parts and prevent premature turbocharger failure.

a. Use a piece of tubing or a mandrel on the shoulder of the shaft and check the floating bearing and clearance on the shaft. It should be between 0.006-0.010 inch (0.15-0.25 mm).

b. Place compressor wheel into compressor housing.

c. Lubricate the bore of the oil seal sleeve and oil seal or diffuser plate with heat resistant non-seizing lubricant or equivalent and insert the oil sealing sleeve assembly. Keep the piston ring compressed until the assembly is started in the bore (fig. 3-102).

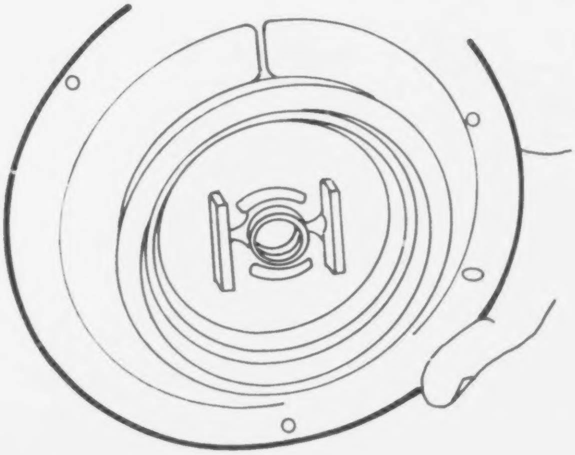


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Figure 3-102. Installing the Oil Sleeve Assembly in the Diffuser Plate.

NOTE

Install the seal assembly from the inside of the oil seal or diffuser plate (sides with the bearing stops). The piston ring must be to the outside of the plate.

d. Lubricate and install a new sealing ring on the lip of the diffuser plate (fig. 3-103). Coat the bearing housing bore with heat-resistant, anti-seize lubricant.

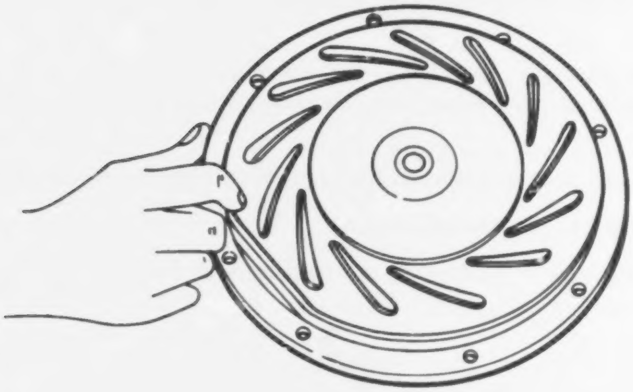

Figure 3-103. Installing the Sealing Ring

e. Carefully move the assembly and rotor support to an arbor press.

f. Lubricate the rotor shaft outside diameter with heat resistant anti seizing lubricant or equivalent; position the compressor wheel on the shaft. Using a suitable mandrel, place the compressor wheel on the shaft until the wheel seats against the sleeve shoulder.

CAUTION

Over-torquing nut will deform shaft.

g. Install the diffuser plate on the collector housing. Aline the index marks, secure with lockwashers and capscrews. Tighten to 5-7 lb-ft (7-9 N·m) torque.

h. Position the Teflon bearing insert over the flange of the floating bearing.

i. Place floating bearing into position on the diffuser plate.

NOTE

The stops on the diffuser plate should be turned so that they seat on the bearing flange 90° from the disassembled position.

j. Lubricate a new O-ring lightly with clean engine lubricating oil and install in the groove of the bearing housing.

k. Lubricate the diffuser plate bore with a heat-resistant anti-seize compound. Insert the bearing housing in the bore of the diffuser plate alining the marks scribed during disassembly until the assembly seats on the shoulder.

l. Position a new metal covered insulation pad on the turbine end of the bearing housing.

m. Install the heatshield on the bearing housing.

n. Position the sealing rings in the grooves on the turbine end of the rotor shaft (fig. 3-104).

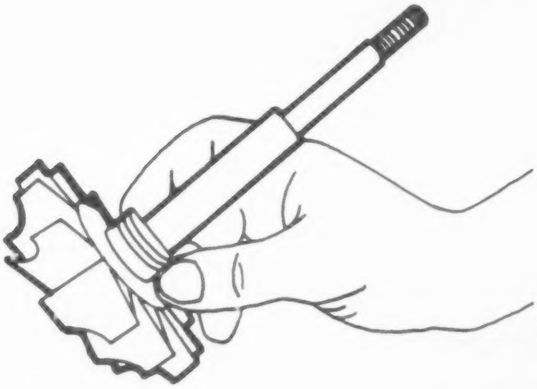

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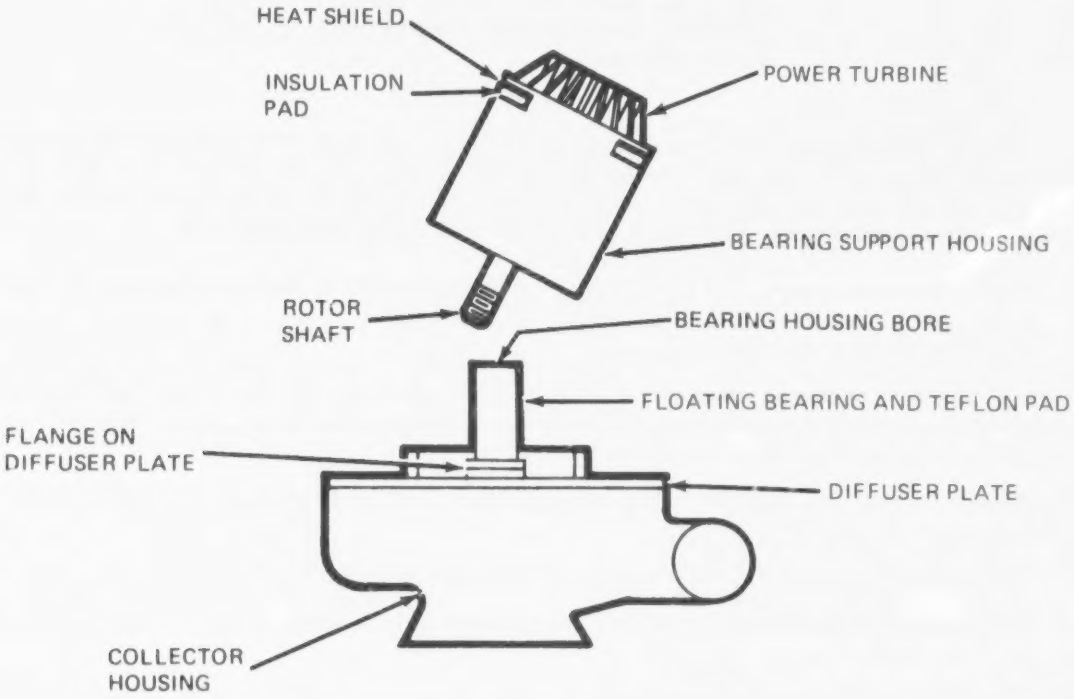
Figure 3-104. Installing the Sealing Ring.

NOTE

Care must be taken to start the sealing rings in the chamfer of the bore to properly compress the ring during installation.

o. Lubricate the rotor shaft with a non-seizing heat resistant lubricant. Insert the shaft into the bearing housing bore (fig. 3-105).


HEAT SHIELD
INSULATION PAD
POWER TURBINE
BEARING SUPPORT HOUSING
ROTOR SHAFT
BEARING HOUSING BORE
FLOATING BEARING AND TEFLON PAD
FLANGE ON DIFFUSER PLATE
DIFFUSER PLATE
COLLECTOR HOUSING

TA 073783

Figure 3-105. Installing the Rotor Shaft.

p. Install a self-locking nut on the rotor shaft. Hold the nut with an end wrench and turn the rotor shaft with the torque wrench to 20-24 lb-ft (27-33 N·m) maximum torque.

q. Lubricate the turbine casing bore with a heat-resistant, anti-seize lubricant. Place on the bearing housing assembly, alining the marks scribed during disassembly, until the assembly seats on the shoulder.

CAUTION

Do not exceed recommended torque; this causes clamp distortion and clamp loosening. Clamp is not to be retorqued during operation.

r. Position the V-bands around the casings, centering the openings of V-bands over the oil supply and drain ports. Secure with new bolts, flatwashers, and self-locking nuts; torque nuts to 32-36 lb-in (36-41 N·m). Tap lightly to seat the V-band while torquing the nuts. Check the clearance between the turbine casing and V-band clamp. There must be a minimum of 0.035 inch (0.89 mm).

s. Check the radial clearance at the turbine end compressor end of the turbocharger as follows:

(1) Push shaft toward side of the bore.

(2) Using a feeler gage, check the minimum distance between the tip of the wheel vanes and the bore. Clearance should be 0.003-0.033 inch (0.08-0.84 mm) on the compressor end and 0.011-0.043 inch (0.28-1.1 mm) on the turbine end.

t. Check the total end clearance with a dial indicator. End clearance should be 0.006-0.018 inch (0.15-0.46 mm).

u. Turn the rotor by hand to make sure no internal interference is present.

v. Cover all oil, air and exhaust inlet and outlets to prevent the entry of any foreign material during storage.

w. Install the lubricating oil inlet and drain fittings. Torque the inlet fitting 20-25 lb-ft (27-34 N·m). Torque the drain fitting to 50 lb-ft (68 N·m).

Section XXIII. REPAIR OF OIL PUMP

3-59. Disassembly.

a. Using a suitable gear puller, remove drive gear (28, fig. 3-106) and crankshaft key (9) from shaft (11).

b. Remove three capscrews (19, 22 and 26) and flat washers (18 and 24) securing the housing (16) to the body (7).

c. Remove three capscrews (23) and lockwashers (25) from inside the housing opening.

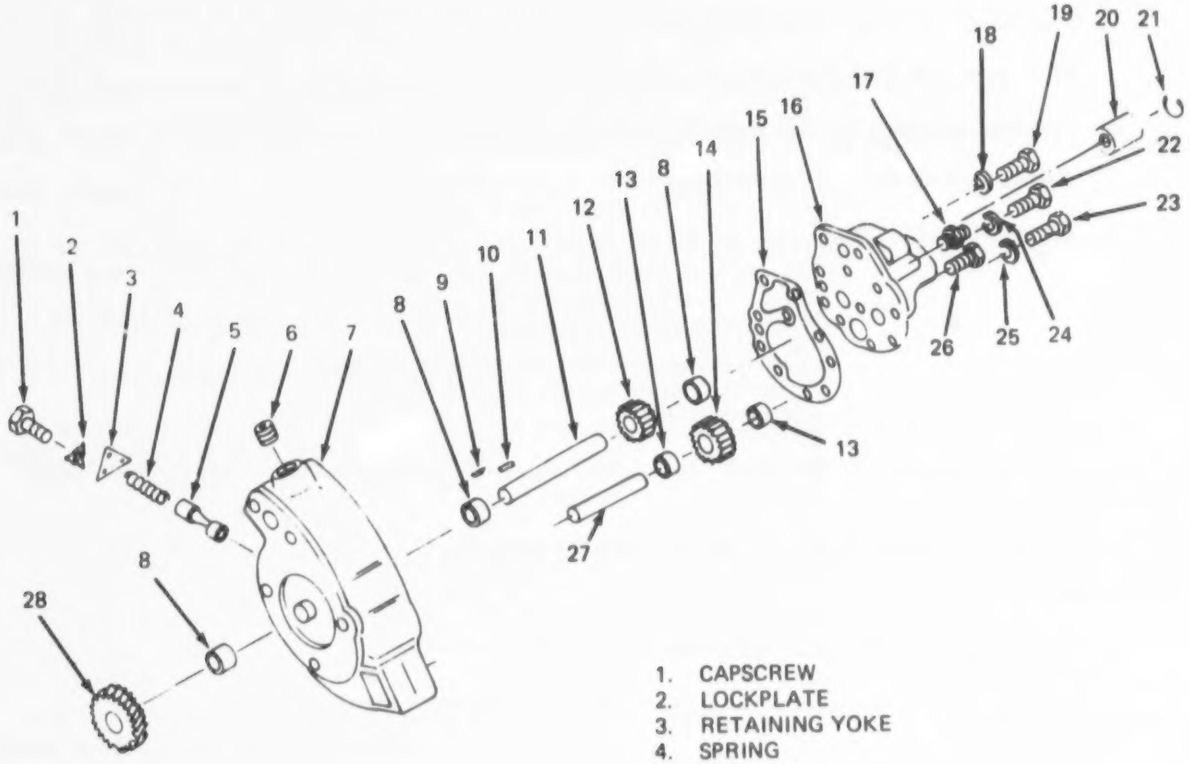
d. Remove snapring (21) and remove coupling (20).

e. Using a soft-nosed hammer, tap the housing (16) loose. Remove the housing.

f. Remove gasket (15).

g. Lift gear (14) from shaft (27).

h. Press shaft (11) and the oil pumping gear (12) from the body (7).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1. CAPSCREW
2. LOCKPLATE
3. RETAINING YOKE
4. SPRING
5. PLUNGER
6. PIPE PLUG
7. BODY
8. SLEEVE BEARING
9. CRANKSHAFT KEY
10. DOWEL PIN
11. SHAFT
12. OIL PUMPING GEAR
13. SPLIT BUSHING
14. GEAR
15. GASKET
16. HOUSING
17. CONNECTOR
18. FLAT WASHER
19. CAPSCREW
20. COUPLING
21. SNAP RING
22. CAPSCREW
23. CAPSCREW (3)
24. FLAT WASHER
25. LOCKWASHER (3)
26. CAPSCREW
27. SHAFT
28. DRIVE GEAR

TA 073784

Figure 3-106. Oil Lubricating Pump – Exploded View.

i. Press shaft (11) from oil pumping gear (12).

j. Press shaft (27) from the body (7), if needed.

k. Remove the dowel pin (10) from the body (7), if needed.

l. Remove connector (17) from housing (16).

m. Remove pipe plug (6).

CAUTION

Spring tension on the pressure regulator may cause the assembly to fly from the body if released suddenly.

n. Remove capscrew (1), lock plate (2) and retaining yoke (3) securing the plunger (5) in the body (7).

o. Remove the spring (4) and plunger (5) from the body (7).

3-60. Cleaning.

a. Refer to para 3-2 for cleaning instructions.

b. Make sure the drilled passages in (11) and shaft (27) are clean and open

3-61. Inspection.

a. Inspect gears (12, 14 and 28) for worn or broken parts.

b. Inspect all parts for burrs, pitting, rusting, scoring, cracks, breaks, distorted threads, and broken out sections or areas.

c. Make sure all oil passages are open and clean without cracks or restrictions.

d. Inspect all mating surfaces for distortion, flatness, gouges, scratches, or any other defect. Remove all gasket material.

e. Check the plunger (5) in pump body for binding, sticking, and excessive looseness.

f. Check the bushings (8 and 13) in the pump body; the inside diameter must be between 0.8767-0.8777 inch (22.268-22.293 mm). The wear limit is 0.879 inch (22.33 mm). Replace if necessary.

g. Check shaft (27) for galling, cracks, breaks, or turning in body (7). The shaft must not be worn smaller than 0.874 inch (22.17 mm).

h. Inspect shaft (11) for turning in gears or worn smaller than 0.874 inch (22.17 mm).

3-62. Repair. Replace all parts found defective or worn to wear limits during inspection (para 3-61 above).

3-63. Assembly.

a. Press oil pumping gear (12) onto shaft (11) 2-1/8 to 2-1/4 inches (53.975-57.15 mm) from splined end of shaft (fig. 3-107).

b. Press new bushings (8 and 13) flush to body surface, if necessary.

c. Insert shaft (11) into the body (7).

d. Press the oil pumping gear (12) on the shaft. The oil pumping gear to body clearance must be 0.060-0.070 inch (1.50-1.80 mm) (fig. 3-107).

NOTE

Using a 0.060-0.070 inch (1.50-1.80 mm) feeler gage between the rear surface of the gear and the pump housing, press the gear snugly. Remove the feeler gage.

e. Press shaft (27) into pump body so that shaft end protrudes 15/16-1.0 inch (23.81-25.40 mm) above body of cover face (fig. 3-106).

f. Install the gear (14) on the shaft (27).

g. Install a new dowel pin (10) in the pump body.

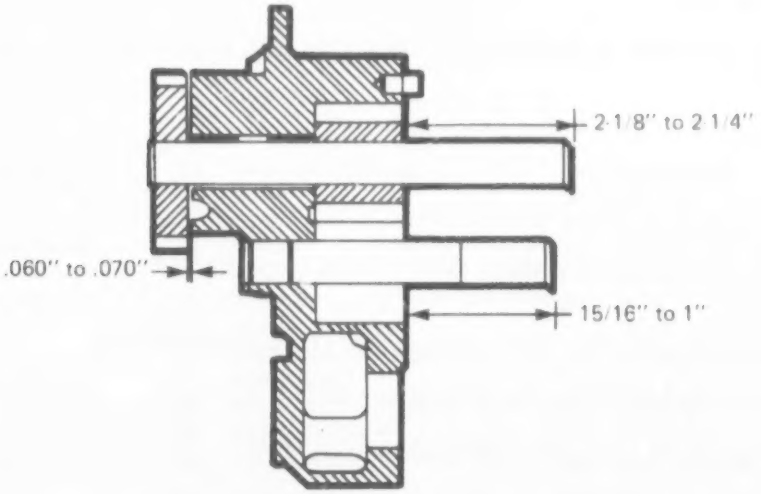

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Figure 3-107. Oil Pump Assembly Dimensions.

h. Lubricate the gears, shafts, bushings and gear pockets with clean engine oil.

i. Install the plunger (5) and spring (4); secure with the retaining yoke (3), lockplate (2) and capscrew (1).

j. Install pipe plug (6).

k. Rotate the drive shaft to make sure the gears are free.

l. Install the housing (16) on the oil pump body (7) using new gasket (15).

m. Secure housing (16) to body (7) with three capscrews (23) and lockwashers (25), one capscrew (26), one capscrew (22) and flatwasher (24), one capscrew (19) and flatwasher (18). Tighten all capscrews securely.

n. Install crankshaft key (9) in shaft (11).

o. Press drive gear (28) over shaft (11).

p. Install connector (17).

q. Check the shaft (11) end play. End play should be 0.002-0.008 inch (0.05-0.20 mm).

r. Install coupling (20) and secure with snapring (21).

3-64. Disassembly.

a. Remove water transfer pipe (5) and preformed packing (4) from support (8). Remove preformed packings (4) from water transfer tube (5).

b. Remove pipe plugs (9, 17, 28, 35, fig. 3-108), pipe elbow (27), and drain cock (36) from the oil cooler assembly.

c. Loosen four hose clamps (29). Remove water header connection (32), hoses (31), and pipe (30) from cover (34).

d. Remove filter (26).

e. Remove capscrew (25), lockwasher (24), flatwasher (23), adapter (22), ring seal (21) and preformed packing (20).

f. Remove seat (14), disc (15), and spring (16).

NOTE

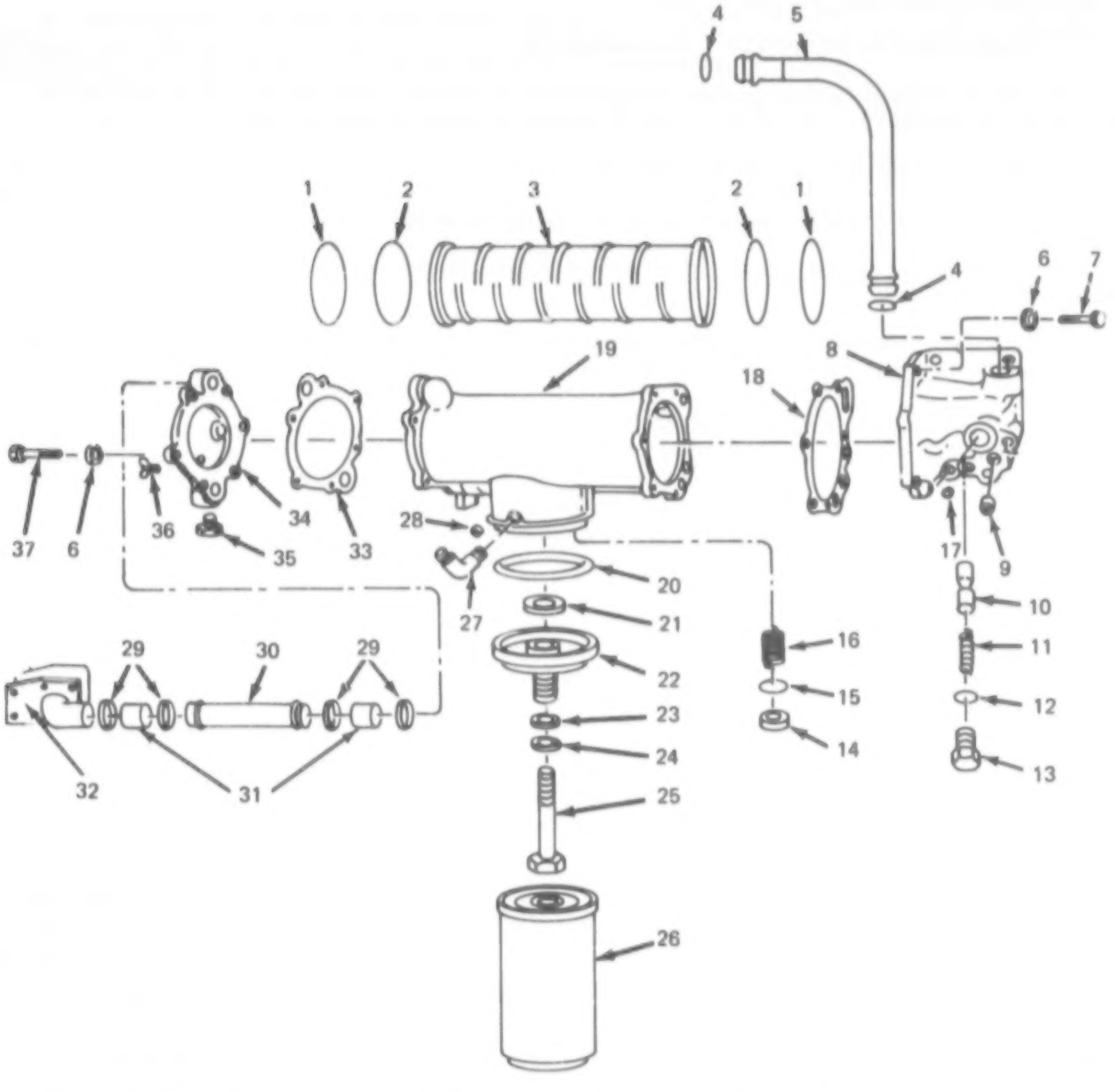
The pressure regulator valve is located
in the cooler support. It controls the
oil pressure before the oil passes through
the filter element.

g. Remove regulator cap (13), gasket (12), spring (11), and plunger (10).

h. Remove six capscrews (7) and six lockwashers (6).

i. Remove support (8) and gasket (18) from housing (19).

j. Remove six capscrews (37) and six lockwashers (6).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1. PACKING RETAINER
2. PREFORMED PACKING
3. ELEMENT
4. PREFORMED PACKING
5. WATER TRANSFER PIPE
6. LOCKWASHER (12)
7. CAPSCREW (6)
8. SUPPORT
9. PIPE PLUG
10. PLUNGER
11. SPRING
12. GASKET
13. REGULATOR CAP
14. SEAT
15. DISC
16. SPRING
17. PIPE PLUG
18. GASKET
19. HOUSING
20. PREFORMED PACKING
21. RING SEAL
22. ADAPTER
23. FLAT WASHER
24. LOCKWASHER
25. CAPSCREW
26. FILTER
27. PIPE ELBOW
28. PIPE PLUG
29. HOSE CLAMP
30. PIPE
31. HOSE
32. WATER HEADER CONNECTION
33. GASKET
34. COVER
35. PIPE PLUG
36. DRAIN COCK
37. CAPSCREW (6)

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Figure 3-108. Oil Cooler and Filter – Exploded View.

k. Remove cover (34) and gasket (33).

l. Remove packing retainers (1) from housing (19).

m. Use dry cleaning solvent to clean out lubricating oil and contaminants trapped in the housing by forcing the solvent through the oil ports in the reverse direction of normal flow.

n. To remove element (3) from housing (19):

(1) Insert two long rods into the outside row of tubes opposite each other.

(2) Place a flat bar on top of the housing and bundle face between the rods, and rotate the element in the housing.

(3) Remove the exposed preformed packing (2) under the retainer. Do not use a sharp object to remove the preformed packings as they may be damaged.

(4) Remove element (3) from the housing.

NOTE

To prevent hardening and drying of foreign substances, clean the element (3) as soon as possible after removal.

3-65. Cleaning (Oil Side).

WARNING

This operation should be done in open air or in a well ventilated room to avoid the toxic effect of the chemicals being used.

a. Immerse the core in dry cleaning solvent; let stand several minutes. Force solvent around the tubes until clean.

b. After cleaning, flush the core thoroughly with hot water.

3-66. Cleaning (Water Side).

a. Plug the oil inlet and outlet.

b. Immerse the oil cooler in solution of one part muriatic acid and nine parts water after adding 1 lb (0.45 kg) of oxalic acid and 0.01 gal (40 ml) of pyridene to each 5 gal (19 l) of acid.

c. Remove core when foaming and bubbling stops. Immerse unit in a 5 percent solution of sodium carbonate. Remove when bubbling ceases and pressure flush with clean, warm water.

NOTE

Flush inside of tubes with clean, light oil after both oil and water sides of cooler have been cleaned.

3-67. Inspection.

a. Seal one end of the tube bundle. Install a suitable air fitting in the opposite end and connect an air supply line. Immerse the tube bundle in water and apply approximately 40 psi (276 kPa) air pressure. If air bubbles are observed, mark the bundle for repair or replacement.

b. Inspect the support for broken or cracked welds. Repair or replace it if necessary.

3-68. Repair (Header Leaks). Header leaks may occur where the tubes protrude through the plate or where the header is soldered into the case. Repair damaged tubes by inserting a smaller outside diameter tube inside the damaged tube. Cut and flare the ends; then solder it securely. Do not damage the tubes or the header material with heat while soldering. If more than 5 percent of the tubes is defective, discard the core element.

3-69. Assembly.

a. To install element (3) in housing (19):

(1) Lubricate a new preformed packing (2, fig. 3-108), using an appropriate mandrel, place in the groove at the bottom of the housing. Make sure the preformed packing is fully seated, not twisted and is free of cuts and nicks.

(2) Push the element (3) carefully into the housing (19), using the alining marks on the housing and element. Do not fully seat element.

(3) Press second preformed packing around the top of the element with equal pressure around the preformed packing circumference. Seat the element carefully.

(4) Install the packing retainers (1) over the preformed packings (2).

b. Position cover (34) and gasket (33) on housing (19).

c. Install six capscrews (37) and lockwashers (6) and tighten to 30-35 lb-ft (41-47 N·m) torque.

d. Position support (8) and gasket (18) on housing (19).

e. Install six capscrews (7) and lockwashers (6) and tighten to 30-35 lb-ft (41-47 N·m) torque.

f. Install plunger (10), spring (11), gasket (12), and regulator cap (13). Tighten regulator cap securely.

g. Install spring (16), disc (15), and seat (14).

h. Lubricate and install a new preformed packing (20).

i. Install ring seal (21), adapter (22), flat washer (23), lockwasher (24), and capscrew (25). Tighten capscrew (25) securely.

j. Install filter (26).

k. Assemble four hose clamps (29), water header connection (32), hoses (31) and pipe (30). Install hose end over cover (34). Tighten hose clamps (29) securely.

l. Install pipe plugs (9, 17, 28, 35), pipe elbow (27) and drain cock (36). Tighten all components securely.

m. Lubricate preformed packings (4) and install over water transfer pipe (5). Install water transfer pipe (5) into support (8).

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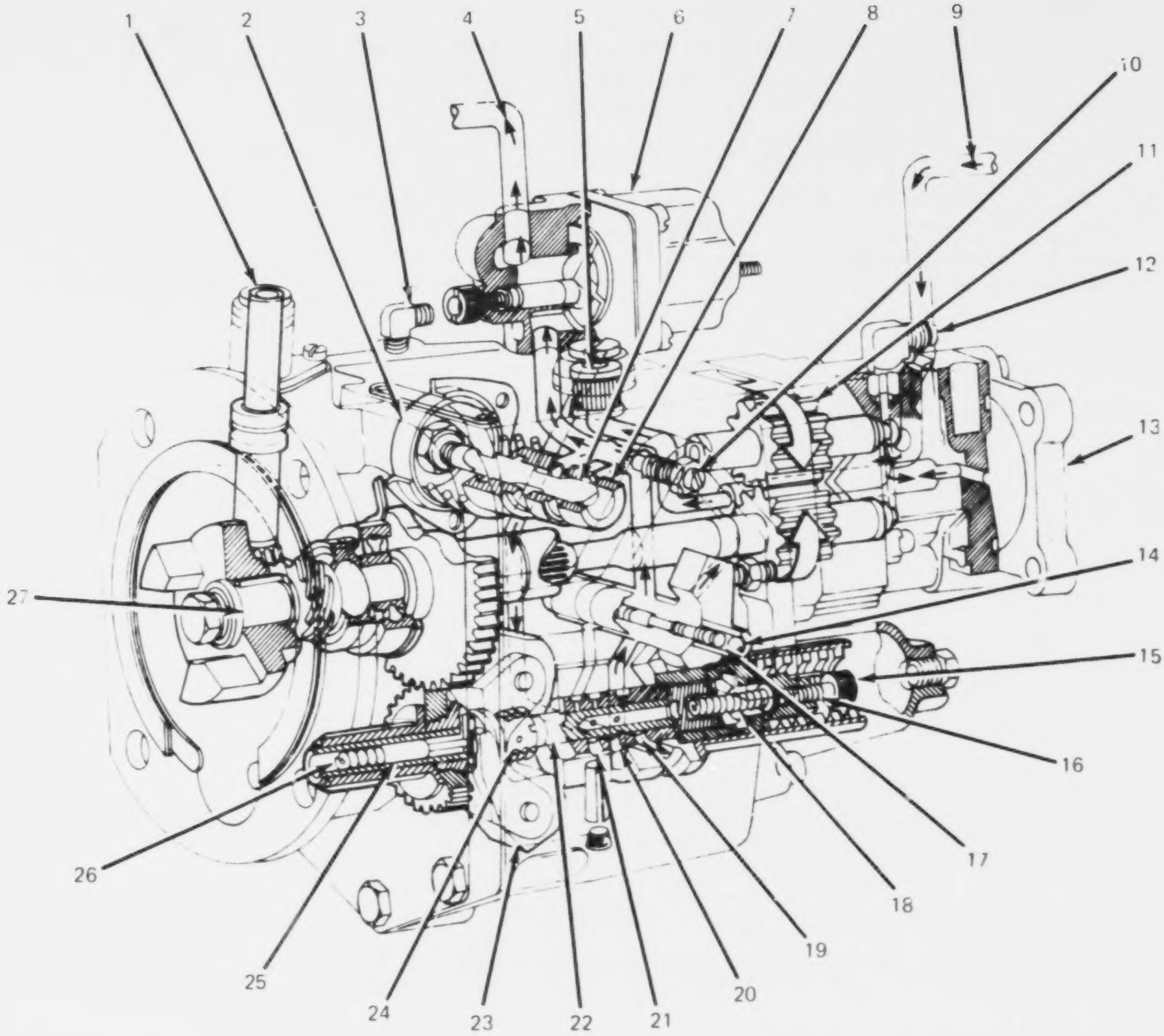

LEGEND

1. TACHOMETER SHAFT
2. AFC PISTON
3. AFC AIR IN
4. FUEL TO INJECTORS
5. FILTER SCREEN
6. SHUT-OFF VALVE
7. AFC PLUNGER
8. AFC FUEL BARREL
9. FUEL FROM FILTER
10. AFC NEEDLE VALVE
11. GEAR PUMP
12. CHECK VALVE ELBOW
13. PULSATION DAMPER
14. THROTTLE SHAFT
15. IDLE ADJUSTING SCREW
16. HIGH SPEED SPRING
17. FUEL ADJUSTING SCREW
18. IDLE SPRING
19. GEAR PUMP PRESSURE
20. FUEL MANIFOLD PRESSURE
21. IDLE PRESSURE
22. GOVERNOR PLUNGER
23. GOVERNOR WEIGHTS
24. TORQUE SPRING
25. GOVERNOR ASSIST PLUNGER
26. GOVERNOR ASSIST SPRING
27. MAIN SHAFT

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Figure 3-109. PTG-AFC Fuel Pump.

Section XXV. REPAIR OF FUEL PUMP

3-70. Pressure Timed Governor – Air Fuel Control Fuel Pump. The PTG-AFC fuel pump assembly is made up of three main units (fig. 3-109):

a. The gear pump (11) which draws fuel from the filter (9) and forces it through the pump filter screen (5) to the governor.

b. The governor which controls the flow of the fuel from the gear pump, as well as the maximum and idle engine speeds.

c. The throttle which provides a manual control of fuel flow to the injectors (4) under all conditions in the operating range.

3-71. Gear Pump and Pulsation Damper.

a. The gear pump (11) is driven by the pump main shaft (27) and contains a single set of gears to pick up and deliver fuel throughout the fuel system. A pulsation damper (13) mounted to the gear pump (11) contains a steel diaphragm which absorbs pulsations and smooths fuel flow through the fuel system.

b. The gear pump (11) is equipped with a bleed line to the engine injector return line which prevents excessive fuel temperatures within the fuel pump. The bleed line functions primarily when the pump throttle is set at idle speed but gear pump output is high due to engine rotative speed. For example, this happens during downhill operation. A special check valve and fitting (12) is used in the gear pump (11) to accomplish the bleed action.

3-72. Throttle. The throttle provides a means for the operator to manually control engine and speed above idle as required by varying operating conditions of speed and load. Fuel flows through the governor to the throttle shaft. At idle speed, fuel flows through the idle port in the governor barrel, past the throttle shaft. To operate above idle speed, fuel flows through the main governor barrel port to the throttling hole in the throttle shaft (14).

3-73. Shutoff Valve. With the electric valve (6), the manual control knob must be fully counterclockwise to permit the solenoid to open the valve when the switch key is turned on. For emergency operation in case of electrical failure, turn manual knob clockwise to permit fuel to flow through the valve.

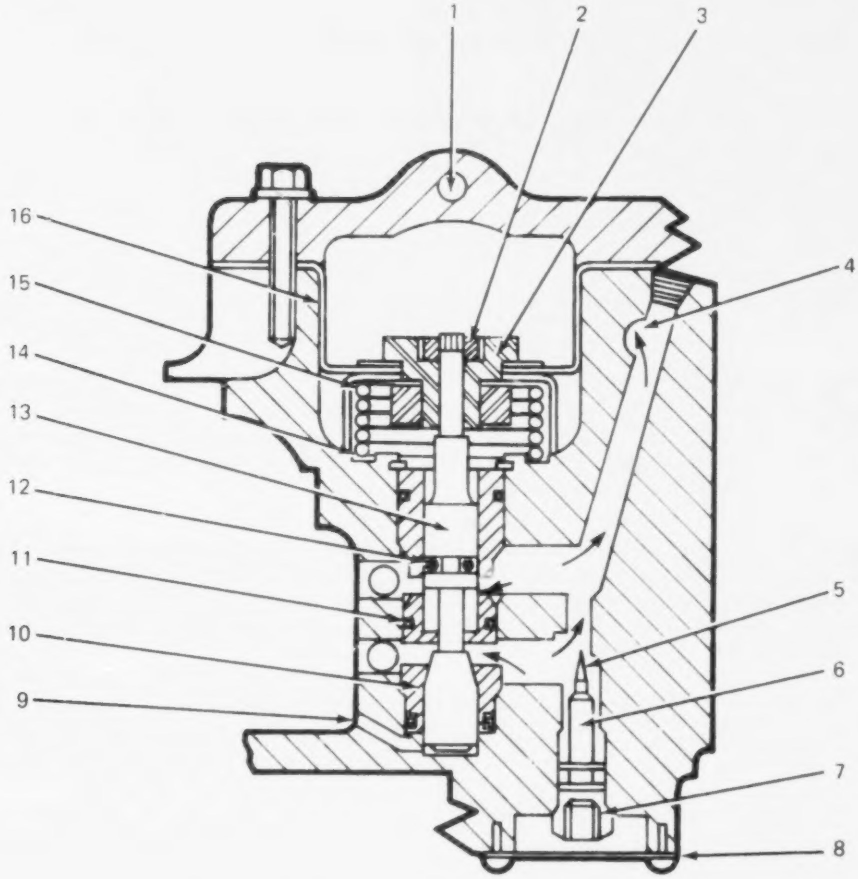
3-74. Idling and High-Speed Mechanical Governor.

a. The mechanical governor is actuated by a system of springs (26) and weights (23), and has two functions. First, the governor maintains sufficient fuel for idling with the throttle control in the idle position; second, it cuts off fuel to the injectors above maximum rated rpm. The idle spring (18) in the governor spring pack positions the governor plunger (22) so the idle fuel port is opened enough to permit passage of fuel to maintain engine idle speed.

b. During operation between idle and maximum speeds, fuel flows through the governor to the injectors (4) in accord with the engine requirements as controlled by the throttle. When the engine reaches governed speed, the governor weights (23) have moved the governor plunger (25) to close the fuel passages to injectors (4). At the same time another passage is opened and fuel is dumped back into the main pump body. In this manner engine speed is controlled and limited by the governor regardless of throttle position. Fuel leaving the pump flows through the shutoff valve (6) supply lines and cylinder head drillings into the injectors.

3-75. Air Fuel Control.

a. The air fuel control (AFC) functions as a fuel pressure and flow restrictor to provide the proper air-fuel delivery rate to the engine during acceleration. The fuel passes through the AFC unit after leaving the throttle shaft and before reaching the shutdown valve, (fig. 3-110).



1. AIR MANIFOLD PRESSURE
2. LOCKING JAM NUT
3. CENTER BOLT
4. FUEL TO SHUTDOWN VALVE
5. FUEL FROM THROTTLE SHAFT
6. NO AIR ADJUSTING VALVE
7. LOCKING JAM NUT
8. THROTTLE COVER PLATE
9. VENT TO HOUSING
10. BARREL
11. BARREL SEALS
12. PLUNGER SEALS
13. PLUNGER
14. WASHER
15. SPRING
16. DIAPHRAGM

TA 073787

Figure 3-110. Cross Section of AFC in Fuel Pump.

b. When no air pressure is on the AFC diaphragm (16, fig. 3-110) fuel from the throttle shaft (5) flows through the no-air adjusting valve (6) passage where the adjusting valve restricts the air pressure and flow. The AFC plunger (13) blocks fuel from passing through the AFC barrel (10). After passing the adjusting valve (6), the fuel flows to the shutoff valve (4).

c. As turbocharger speed and intake air manifold pressure (1) increases, the air pressure acting on the AFC diaphragm (16) and piston overcomes the AFC spring (15) force, causing the AFC plunger (13) to move away from the AFC cover plate. As the plunger (13) moves, the plunger chamfer begins allowing fuel to flow through a drilling in the AFC barrel (10) common to the drilling from the fuel throttle shaft (5). This allows fuel to bypass the no-air adjusting valve (6) and flow down the AFC barrel (10) to a second drilling leading to the shutoff valve. As the intake manifold air pressure (1) increases, the AFC plunger (13) uncovers more of the drillings until a minimum fuel restriction level is reached and intake manifold air pressure above the AFC unit holds the plunger in full fuel position.

3-76. Removal of Fuel Pump Units. The fuel pump was removed with the air compressor. This unit covers disassembly of the fuel pump. Inspection should be performed at all times during rebuild work.

3-77. Clean and Mount.

a. Clean outside of fuel pump thoroughly with drycleaning solvent. Remove the lockwires and seals.

b. Mount the fuel pump on a suitable mounting plate and swivel vise (fig. 3-111).

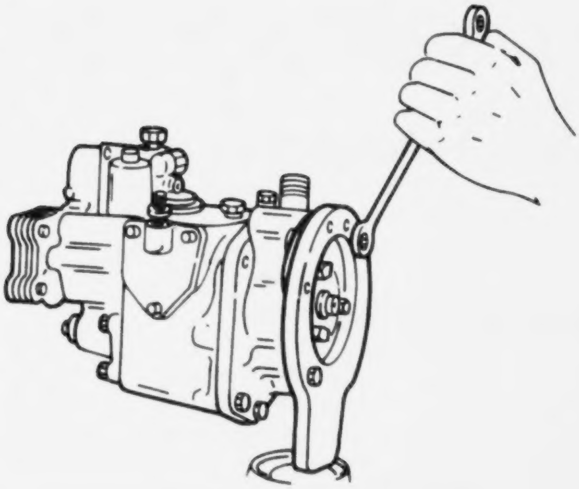


Figure 3-111. Mounting the Fuel Pump to the Mounting Plate and Swivel Vise.

3-78. PTG-AFC Fuel Pump Service Cooling Kit.

a. Remove the check valve and orifice elbow assembly from the back side of the fuel pump.

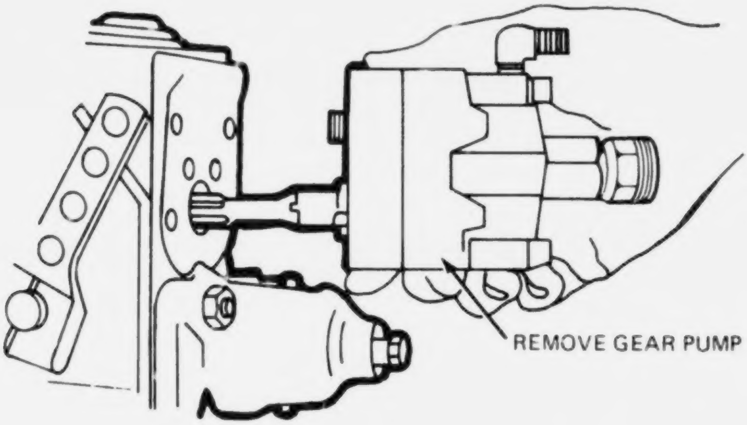
b. Clean the parts in clean fuel oil and dry with compressed air blown through both ends.

3-79. Shutoff Valve, Pulsation Damper and Gear Pump.

a. Remove the shutdown valve from the top of the main housing.

b. Remove the pulsation damper from the gear pump and discard the O-ring.

c. To remove the gear pump from the main housing, tap the shoulder on the sides of the gear pump with a plastic hammer to loosen from dowel. Remove gear pump (fig. 3-112).



TA 073916

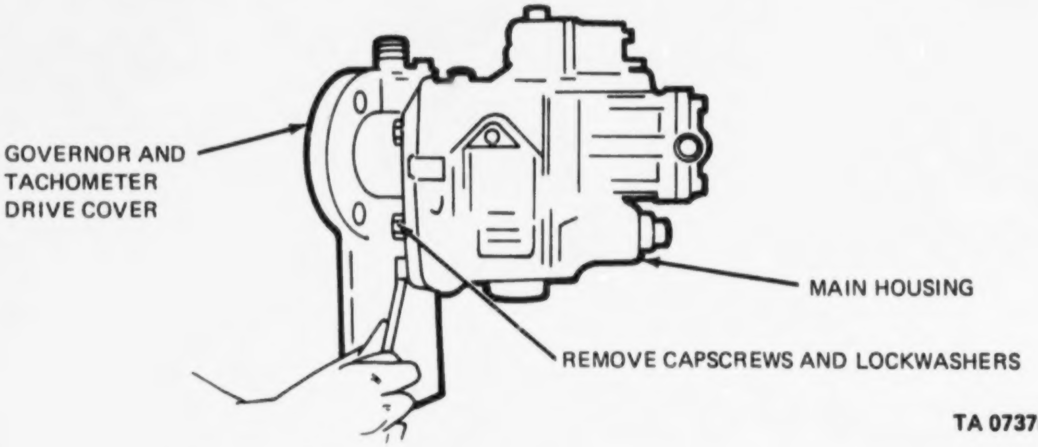
Figure 3-112. Removing the Gear Pump.

3-80. Front Drive Cover and Governor Plunger.

CAUTION

Never use a steel hammer on aluminum, or on a finished surface; it can cause extensive damage.

a. To remove the governor and tachometer drive cover from the main housing, remove the seven capscrews and lockwashers (fig. 3-113) and tap the edge of the cover lightly with a plastic hammer to loosen. Lift the cover off the dowels (fig. 3-113).


GOVERNOR AND TACHOMETER DRIVE COVER
MAIN HOUSING
REMOVE CAPSCREWS AND LOCKWASHERS

TA 073788

Figure 3-113. Removing the Governor and Tachometer Drive Cover from the Fuel Pump.

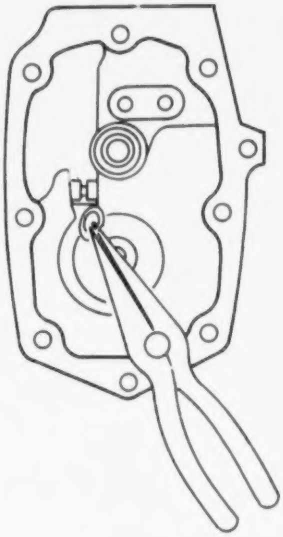
CAUTION

Place the plunger where it will not be damaged;
a slight nick can cause extensive damage.

b. Remove the weight-assist plunger, spring and shims from weight carrier assembly. Slide governor plunger from barrel.

3-81. Throttle Assembly — Drive Screw Cover Plate.

a. Remove the snap ring from inside the housing (fig. 3-114). Remove the four screws securing the cover plate. Pull the throttle assembly from the housing. Remove O-ring and discard.



TA 073789

Figure 3-114. Removing the Snap Ring from the Throttle Shaft.

b. If the throttle shaft bushing is damaged replace the bushing.

c. Loosen the jamnut and remove no air AFC fuel adjusting screw and discard O-ring.

3-82. Governor Spring Pack Cover.

a. Remove the spring pack cover from the main housing; lift off the cover.

b. For disassembly of spring pack, refer to paragraph 3-105, below.

Paragraph 3-83 deleted.

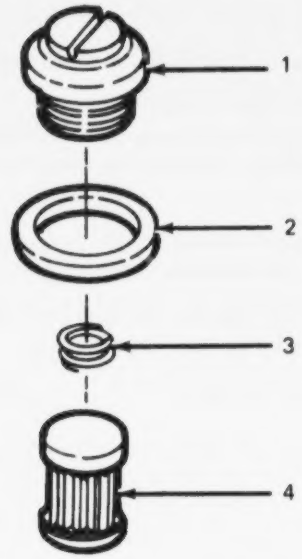
3-84. Tachometer Drive.

a. Remove the tachometer drive coupling from the front cover.

b. Carefully drive the tachometer drive assembly from the pump, using a brass punch and hammer.

c. Remove the oil seal from the shaft.

3-85. Fuel Pump Filter Screen — Disassembly and Inspection. The single filter screen assembly mounts in the top of the fuel pump housing.



1. CAP
2. SEAL
3. SPRING
4. SCREEN AND MAGNET

TA 073790

Figure 3-115. Fuel Filter Screen — Exploded View.

a. Screw off the screen cap (1, fig. 3-115) on top of the housing. Lift the cap (1), seal (2), spring (3) and screen and magnet (4) from the main housing.

b. Clean retainer in fuel oil and blow dry with compressed air. Visually inspect retainer and magnet for damage or excessive wear.

c. Proper cleaning of the filter screen can best be accomplished by soaking in dry cleaning solvent, followed by flushing in a sonic cleaner unit; or, clean the screen in fuel oil and dry with compressed air.

d. Visually inspect the screen for holes or imbedded metal particles in the mesh.

e. Discard damaged or worn parts and replace with new parts.

3-86. Fuel Pump Housing. The fuel pump housing is the largest part of the fuel pump and contains the governor barrel and throttle shaft. Other units attach to the housing. The drive shaft bushing, throttle sleeve, governor barrel and spring pack housing are in the fuel pump main housing.

3-87. Drive Shaft Bushing.

a. Check the drive shaft bushing for signs of seizure or burrs.

b. Check the drive shaft bushing inside diameter with inside micrometers; if worn beyond 0.7525 inch (19.11 mm) replace the bushing.

c. Remove the worn bushing using a gouge chisel or half-inch pipe tap. After tapping the bushing, screw a half-inch nipple into the bushing. Insert a punch through the rear of the housing and drive out the bushing.

d. Apply a thin coat of high-pressure lubricant to a new front drive shaft bushing; press the bushing into the housing flush with the housing bore using an arbor press.

e. Line ream the bushing to 0.7495-0.7505 inch (19.04-19.06 mm) with a suitable ream fixture, and a well-oiled 0.750 inch (19.05 mm) reamer (fig. 3-116).

f. Recheck the bushing inside diameter.

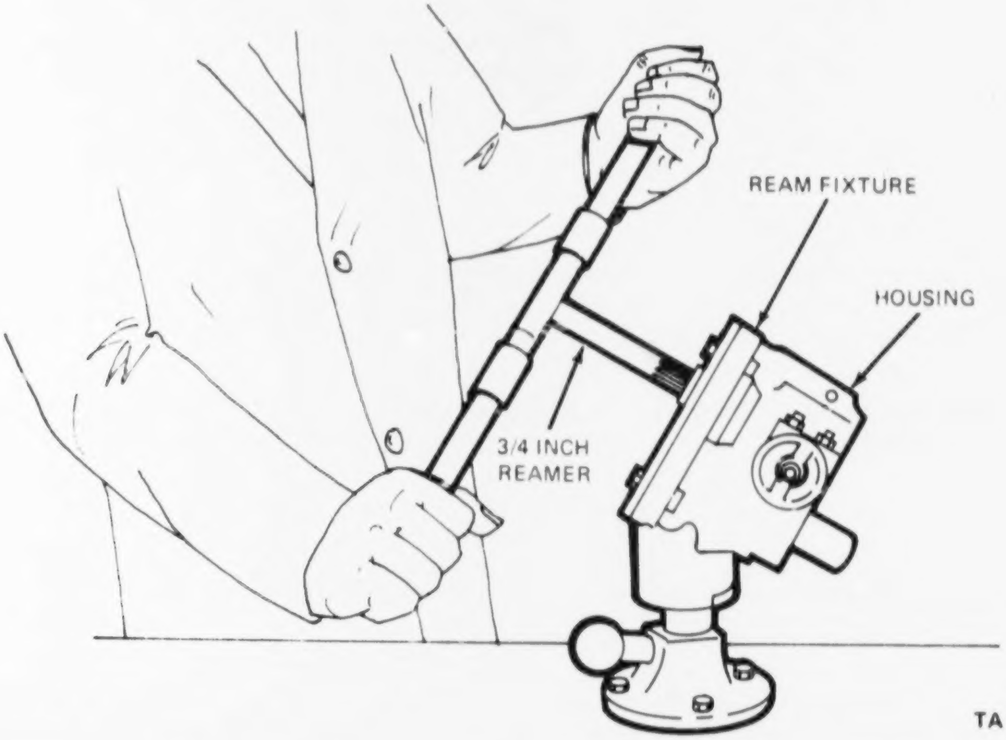


Figure 3-116. Reaming the Drive Shaft Bushing.

3-88. Governor Barrel, Plunger and Spring Pack Housing.

a. Inspection.

(1) Check the governor barrel and plunger visually for wear.

(2) If worn, replace the governor plunger with a new plunger of the same class size as etched on face of governor barrel.

NOTE

Due to the hardness of governor barrel sleeve, it wears very little. If worn excessively or if plunger shows signs of scoring, the barrel should be replaced.

b. Standard Governor Barrel Replacement.

(1) If the governor barrel is worn or shows signs of scoring, it will be necessary to heat the housing in an oven to 300°F (149°C) and press out the governor barrel. Heat will expand the aluminum housing and permit the steel barrel to be pressed out with less chance of damaging the housing bore.

NOTE

Check through plug hole in bottom of the pump for the spring dowel which secures barrel in fuel pumps before attempting to remove the governor barrel. Sometimes a wire hook, inserted into the hole provided, will pull the spring dowel (fig. 3-117).

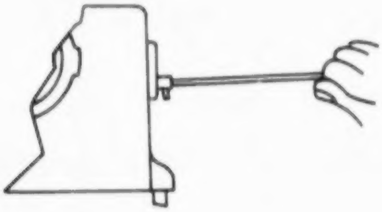


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Figure 3-117. Removing the Spring Dowel from the Bottom of the Barrel.

(2) Check the barrel bore in the housing to determine whether standard and 0.5020-1.5025 inch (38.15-38.16 mm) outside diameter barrel, 0.010 inch (0.25 mm) or 0.020 inch (0.51 mm) oversize must be used. Minimum 0.002 inch (0.05 mm) interference fit is required. Check the bore for score marks; remove marks if found.

3-89. Assembly and Fitting.

a. To locate a new governor barrel in the housing, scribe a centerline on the barrel and housing, lining up the fuel passages so fuel flow will not be restricted (figs. 3-118 and 3-119).

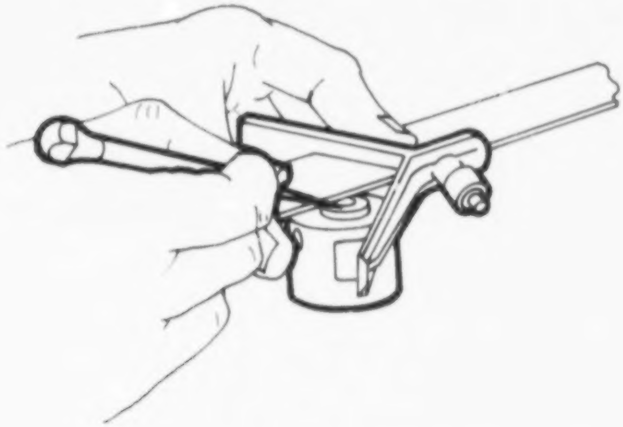
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Figure 3-118. Scribing a Centerline on the Governor Barrel.

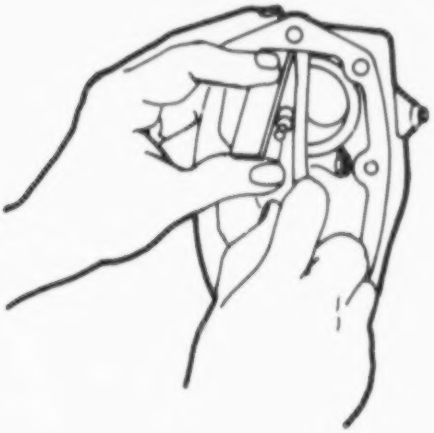
TA 073802

Figure 3-119. Scribing a Centerline on the Fuel Pump Housing.

b. Heat the housing in an oven to 300°F (149°C).

c. Coat the new governor barrel with high-pressure lubricant. Drop the spring pack housing in place.

d. Place the governor barrel in the housing bore with the chamfered end first and location pin hole on the bottom side, lining up the scribe marks. Then press the barrel into the housing with an arbor press until it bottoms against the spring pack housing. This is important to aline the barrel retaining pin holes.

e. Replace barrel sleeve and plunger as a matched set.

f. Install the spring dowel into the bottom of the barrel with an ST-853 driver with the slot of the pin to the front of the housing.

3-90. Governor Plunger.

a. Remove the torque spring by twisting the spring off the shoulder. Do not use a straight pull which will stretch the spring beyond its elastic limit requiring it to be replaced (fig. 3-120).

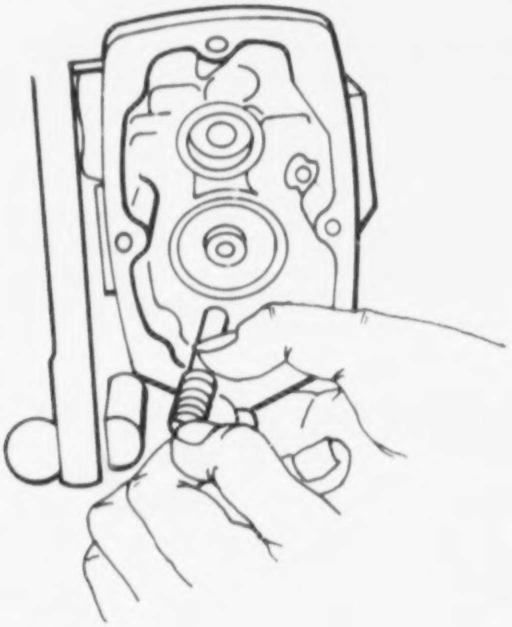

Figure 3-120. Removing the Torque Spring.

b. If governor plunger outside diameter is worn, replace it with a new plunger of same class size as etched on barrel face.

c. If only the thrust washer is worn, drive the retainer pin from the plunger and pull the governor plunger drive from the plunger.

NOTE

The chamfer on the small diameter of the thrust washer is provided as a relief for fillets of plunger driver.

d. If it is necessary to remove the stop sleeve, press the stop sleeve off the shaft.

3-91. Assembly.

a. If the stop sleeve was removed, press the stop sleeve on the plunger with the notched end going on the plunger first (notches toward the governor barrel).

CAUTION

The plunger has a lubrite finish. Protect it by laying the plunger on a copper-jawed vise or V-block to prevent damage to the finish when installing pin.

b. Assemble the plunger drive through the thrust washer and drive into the plunger. The driver must have interference fit in the plunger.

c. Drive the retainer pin through the plunger and plunger driver.

NOTE

The chamfered side of the thrust washer must be installed next to the driver. There must be at least 0.002-0.005 inch (0.05-0.13 mm) clearance between the washer face and the driver so the washer will "float".

d. Install the torque spring and shims as required, put the small end of the spring on the shoulder end of the plunger with a twisting motion to avoid distorting the spring.

Table 3-6. Springs and Specifications.

Color Code	Wire Dia Inches (mm)	Number	Pounds Load (Kg)	Length Inches (mm)	Free Length Inches (mm)
Red/Yellow	0.051 (1.30)	5.5	6.60/7.04 (3.0/3.2)	0.340 (8.64)	0.640/0.660 (16.26/16.76)
Red/Purple	0.148 (3.76)	3.7	47.0/51.0 (21.32/23.13)	0.850 (21.59)	1.200 (30.48)

3-92. Air Fuel Control.

a. Disassembly

(1) Remove the air signal attenuator (ASA) valve from the cover plate.

(2) Remove AFC cover plate (fig. 3-121).

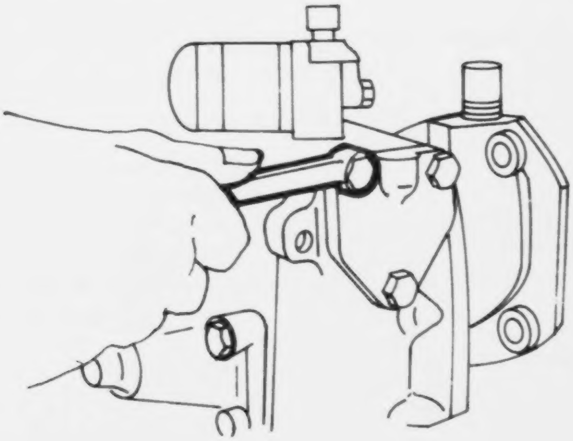

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Figure 3-121. Removing the AFC Side Cover Plate.

(3) Carefully lift the diaphragm away from the sealing surface around the AFC cavity and pull the piston and plunger assembly from the AFC barrel (fig. 3-122).

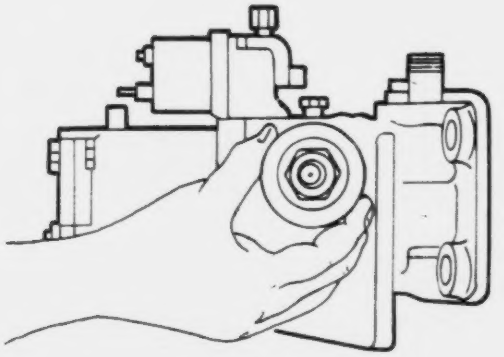

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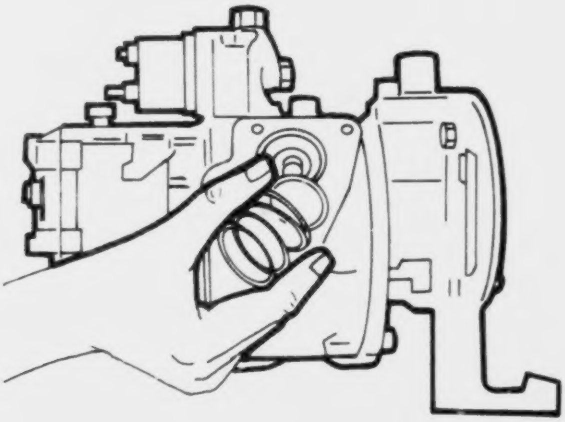
Figure 3-122. Removing the AFC Diaphragm and Piston Assembly.

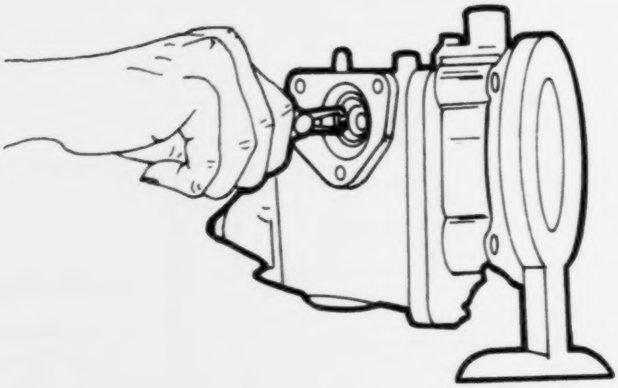
(4) Remove the AFC compression spring and steel shim between the spring and fuel pump housing (fig. 3-123).



TA 073806

Figure 3-123. Removing the AFC Compression Spring and Shim.

(5) Remove the AFC barrel retaining ring (fig. 3-124).



TA 073807

Figure 3-124. Removing the AFC Barrel Retaining Ring.

(6) Remove the AFC barrel.

(7) Remove the plunger jam nut and unscrew the plunger from the center bolt.

(8) Remove the center bolt jam nut, washer, and gasket; remove diaphragm from piston.

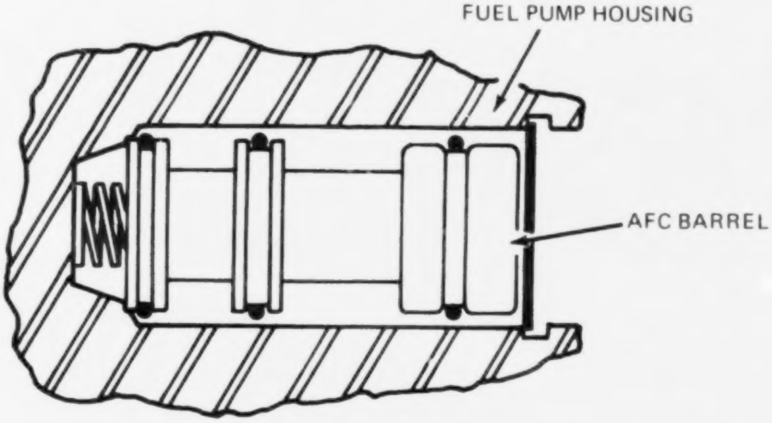
(9) Slide the glide ring and O-ring seal assembly from the AFC control plunger.

b. AFC Assembly Installation

(1) Lubricate the barrel O-rings and install in the grooves in the barrel. Press the barrel into the housing and secure with the snap ring.

NOTE

If barrel is loose, remove the barrel and place the spring behind the barrel. Secure with the flat snap ring (fig. 3-125).



TA 073808

Figure 3-125. AFC Barrel, with Spring, in the Fuel Pump Housing.

(2) Place the steel shim in the diaphragm spring set groove.

(3) Install the spring with the small end in the housing (fig. 3-123).

(4) Lubricate the O-ring and install over the control plunger using installation tool 3375146, then install the glide ring over the tool and plunger on top of the O-ring.

NOTE

If the barrel contains a 15° plunger lead in chamfer, do not use glide ring forming tool.

(5) Assemble the center bolt, gasket, washer (rounded edge toward diaphragm, diaphragm (with part number toward piston), piston, washer and jam nut.

(6) Hold the assembly by the hex on the center bolt and center the diaphragm piston and washers; without twisting the diaphragm, tighten the jam nut to 30-40 lb-in (3.4-4.5 N·m). Make sure the parts are centered.

(7) Wrap the plunger threads with Teflon tape and screw the plunger into the center bolt until the threaded end of the plunger is flush with the center bolt surface. Install the jam nut, but leave loosened.

(8) Slide the plunger and piston/diaphragm assembly into the barrel. Insert the assembly very carefully to avoid damage to the glide ring (fig. 3-122).

(9) Cup the diaphragm downward between the piston and housing to ensure the diaphragm does not wrinkle when the cover is installed.

(10) Line up the diaphragm holes with the housing and cover plate holes; install the capscrews and washers. Capscrews are to be tightened to 30-35 lb-in (3.4 - 4.0 N·m),torque after setting the AFC on test stand (fig. 3-121).

(11) Install the lubricated O-ring on the needle valve using assembly tool 3375148, and screw it into the housing above the throttle shaft until it bottoms in the housing; install jam nut loosely until set on the test stand.

(12) Install the ASA valve in the cover plate.

3-93. Tachometer Drive-Mechanical

a. *Disassembly*

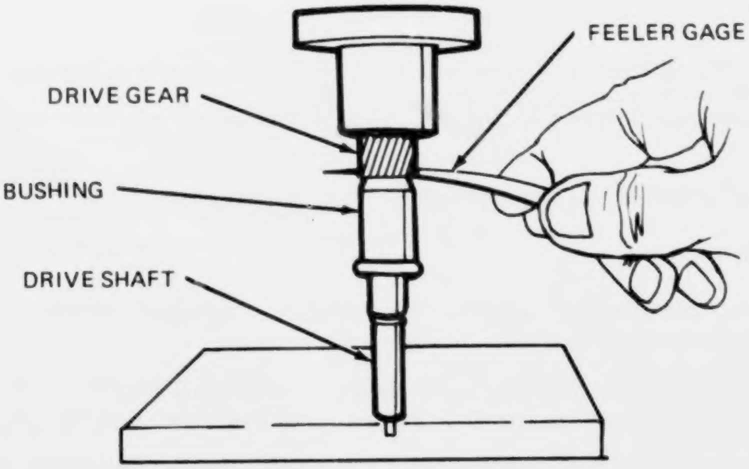
(1) Remove the oil seal from the tachometer drive shaft.

(2) Press the tachometer drive shaft from the drive gear and bushing if the gear is badly worn or the shaft and bushing are galling or scoring. Check the snaft outside diameter and the bushing inside diameter. Replace if necessary. See table 3-7.

Table 3-7. Tachometer Drive Parts Specifications.

Part Description	Inch (mm)
Tachometer Shaft	0.3950/0.3955 (10.033/10.046)
Shaft Bushing	0.3963/0.3970 (10.066/10.084)

b. *Assembly.* Place the bushing on the tachometer shaft with chamfered end of the bushing toward the gear end. Press the gear onto the shaft until flush with the end of the shaft (fig. 3-126). Check to see that the shaft turns freely in the bushing. Maximum clearance between the gear and the bushing is 0.005 inch (0.127 mm).



TA 073809

Figure 3-126. Pressing the Tachometer Gear on the Shaft.

3-94. Gear Pump and Pulsation Damper. The gear pump draws fuel from the tank through a filter and supplies the fuel to the fuel pump. Fuel at a given pressure is then routed to the injectors.

3-95. Gear Pump. The gear pump has a hollow idle shaft and the gear pump cover is drilled for cooling.

CAUTION

Engines with integral cooling gear pumps (fig. 3-127) must not be run with the fuel bleed hole plugged.

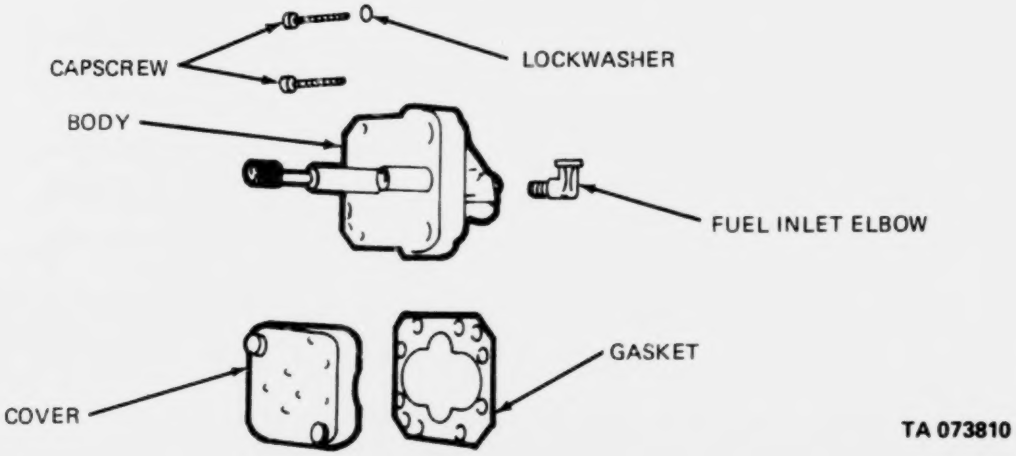


Figure 3-127. Gear Pump with Integral Cooling.

a. Disassembly

(1) Remove the capscrews and lockwashers securing the gear cover to the gear body.

(2) Drive against the dowels with flat end punch to remove the gear cover from the dowels in the gear body.

(3) Lift the drive and driven gears and shafts from the gear pump body.

b. Cleaning and Inspection

(1) Check the pump shafts for wear or scoring; discard if damaged. Replace the shaft if worn smaller than 0.4998-0.5001 inch (12.695-12.703 mm) diameter.

(2) Check the gear width. The gear width should be between 0.7483 and 0.7486 inch (19.006 and 19.014 mm). If the gears are scored or show signs of wear, they must be replaced.

(3) Check the gear body and cover for scoring and wear; replace parts as needed. Check the gear pocket depth. Gear pocket depth must be between 0.7478 and 0.7483 inch (18.994 and 19.006 mm).

(4) The shaft bore in the cover and body should be 0.5013-0.5016 inch (12.733-12.740 mm) inside diameter in 7/16 inch (11.11 mm) and 3/4 inch (19.05 mm) and 0.5015-0.5018 Inch (12.738-12.746 mm) inside diameter in 1 inch (25.4 mm) and 1-1/4 inch (31.75 mm) in current cast iron bearing gear pumps. If the gears are removed from the shaft, press the gears on the shaft 0.680-0.690 inch (17.27-17.53 mm) from the body end of the shaft. Oil the shaft before assembly.

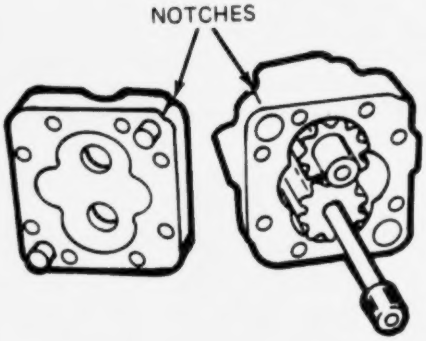
(5) Check the lubrication holes in the cover and body; they must be clean.

(6) Clean the cooling kit components, and dry with compressed air.

c. *Assembly*

(1) Lubricate and slide the shafts and gears into the cover. Make sure the parts are clean.

(2) Position a new gasket and install the body to the cover. Aline the locating notches together (fig. 3-128).



TA 073811

Figure 3-128. Locating Notches or Ridges for Right-Hand Rotation Pump.

NOTE

Location of notches or ridges and drive shaft determines pump rotation.

(3) When a right-hand rotation pump is being assembled, place the driven gear shaft of the gear pump in the pocket nearest the locating notches or ridges. Place the driving gear shaft in the other pocket. The dowel ring is always located around the drive shaft.

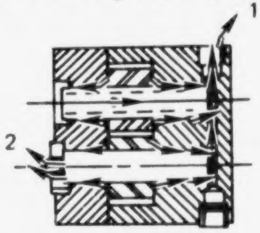
(4) Secure the cover and housing with dowels, tighten the capscrews to 11-13 lb-ft (15-18 N·m). Check to see that the pump turns freely with finger pressure.

NOTE

Total gear backlash must be 0.001-0.004 inch (0.025-0.102 mm). The drive shaft must protrude 2.370-2.412 inch (60.2-61.3 mm) from the body. End clearance should not exceed 0.0015 inch (0.0377 mm) nor be less than 0.0009 inch (0.0228 mm). Gaskets are available in 0.0020 inch (0.051 mm) (red) and 0.0015 inch (0.038 mm) (purple). If pump binds or has excessive play, check for error in assembly which must be corrected to prevent early pump failure.

3-96. Fuel Pump Cooling

a. A small amount of fuel is routed back to the fuel tank during engine operation. This bleed fuel is the fuel which flows through and lubricates the gear pump bearing bores. With an integral bleed gear pump, the lubricating fuel flow through the three gear pump bearings is bled off through an external tapped drain hole (fig. 3-129).



1. TO INJECTOR DRAIN LINE OR FUEL TANK
2. TO FUEL PUMP HOUSING

TA 073812

Figure 3-129. Gear Pump Fuel Flow.

b. The inboard main shaft bearing bore returns its fuel to the gear pump suction. The inboard idler shaft bearing fuel flows through the hollow idler shaft to the external drain line. As can be seen from the sketch, both outboard gear pump bearings drain externally.

CAUTION

Under no circumstances should the pump be operated with cooling return flow plugged. This fuel flow is necessary to lubricate the bearing surfaces within the gear pump.

c. Since three of the bearing bores drain externally, it is apparent that both tapped holes in the gear pump housing cannot be plugged. Plugging both tapped openings will prevent lubricating and cooling fuel flow through the three bearing bores and gear pump seizure will occur.

(1) Install the cooling elbow in the 1/8 inch N.P.T.F. hole in the top of the gear pump.

NOTE

The spring-loaded check valve is necessary to prevent fuel in pump from draining away and causing hard starting.

(2) The check valve may be pressure checked with calibration test oil, in the direction of flow at 4-9 psi (27.6-63 kPa).

(3) To test for leakage, apply 3 1/2 psi (24 kPa) for 5 minutes. Replace check valve if leakage occurs.

(4) To test for leakage in the opposite direction of flow, apply 1/4 psi (172 kPa) for 5 minutes. Replace if the check valve leaks.

3-97. Pulsation Damper.

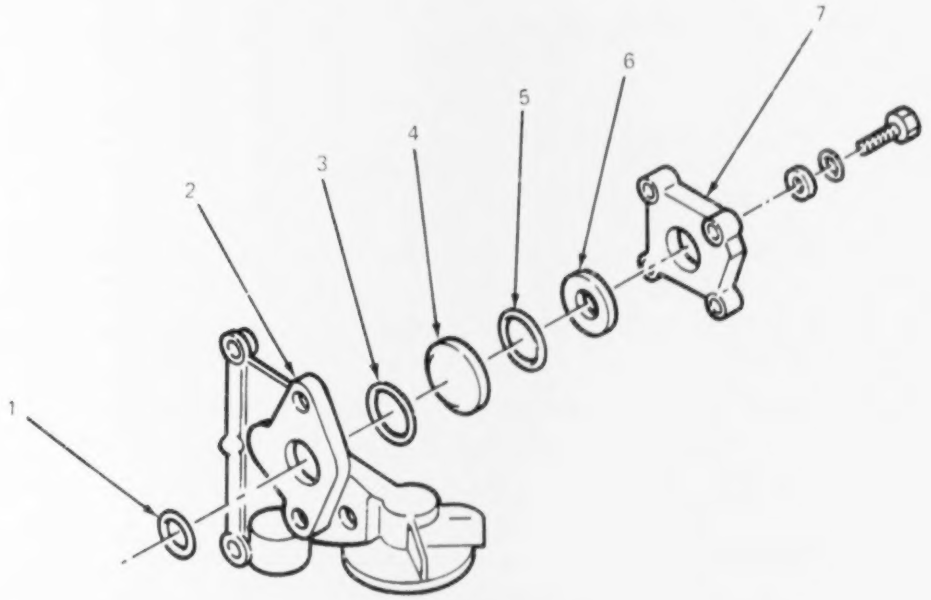
a. Disassembly and Inspection.

(1) Remove the plate (7, fig. 3-130) from the body (2). Remove the spring steel diaphragm (4).

NOTE

Diaphragm must be kept clean prior to assembly.

(2) Check for corrosion, excessive wear or cracks in the cover and diaphragm. Replace if necessary (fig. 3-130).



LEGEND

1. SEAL
2. BODY
3. O-RING
4. DIAPHRAGM
5. O-RING
6. NYLON WASHER
7. PLATE

TA 073813

Figure 3-130. Pulsation Damper – Exploded View.

b. Assembly.

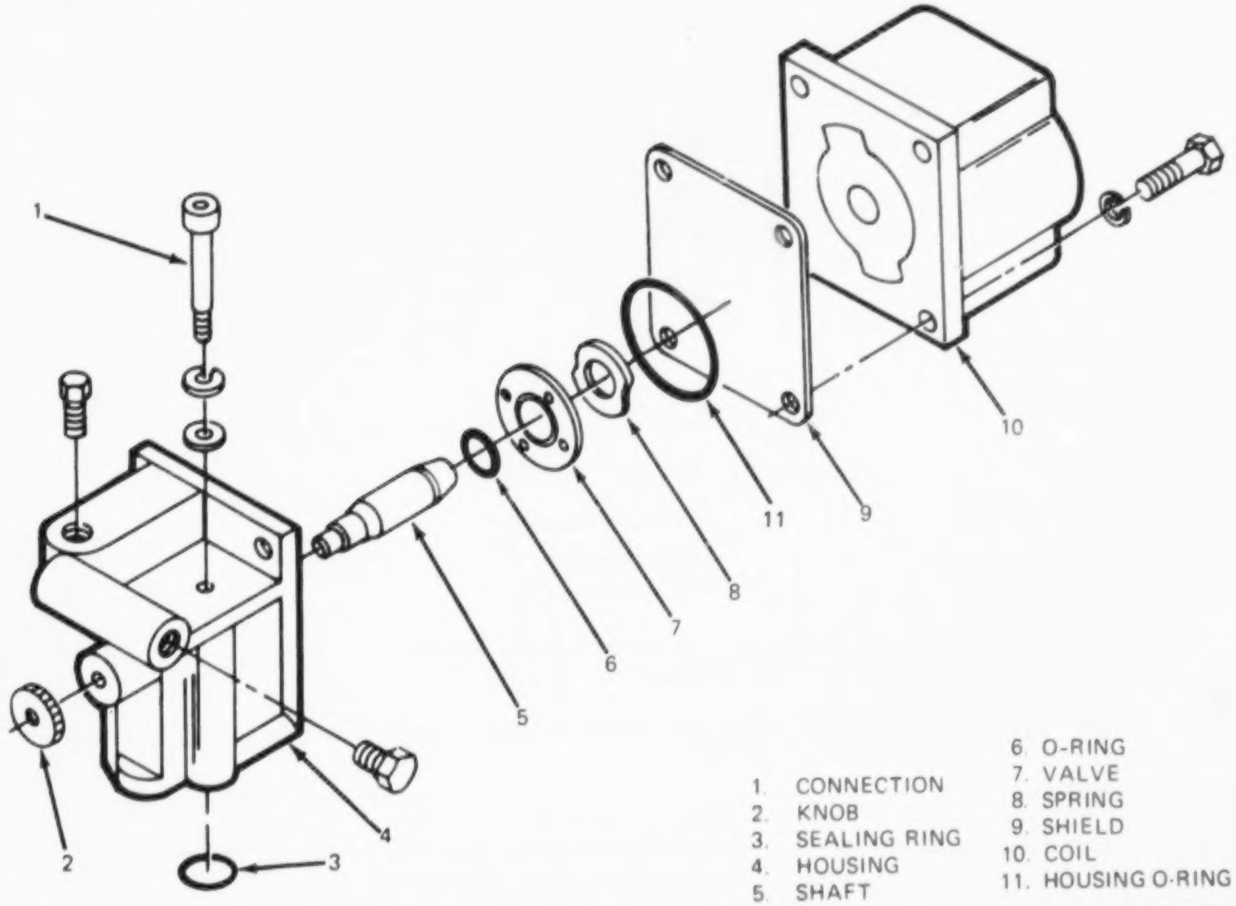
(1) Install new O-rings in the grooves, and a new nylon washer (6).

(2) Coat the diaphragm with a good grade of 10W or 20W oil and lay in the cover.

(3) Assemble the plate to the body; torque the capscrews to 11-13 lb-ft (15-18 N·m).

3-98. Electric Shutoff Valve. The electric shutoff valve is held open while current is flowing through the solenoid. When current is not flowing, the valve will shut unless the shutoff valve is locked open manually.

a. Disassembly. Remove the coil housing (10, fig. 3-131) from the valve housing (4). Remove the coil housing and fuel shield (9). Remove the spring washer (8) and plate type valve (7). Remove the manual override knob (2), and unscrew the override shaft (5) from the coil end. See figure 3-131.



1. CONNECTION
2. KNOB
3. SEALING RING
4. HOUSING
5. SHAFT
6. O-RING
7. VALVE
8. SPRING
9. SHIELD
10. COIL
11. HOUSING O-RING

TA 073814

Figure 3-131. Electric Shutoff Valve - Exploded View.

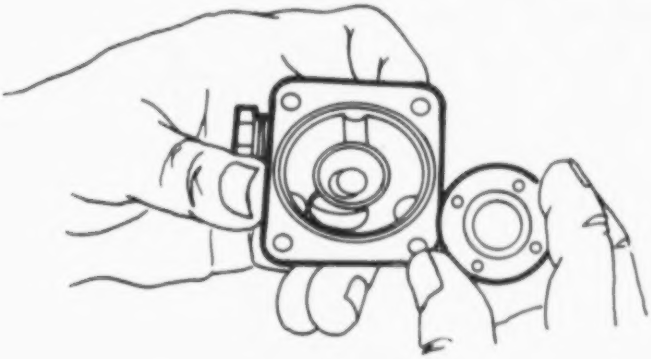
b. Cleaning and Inspection.

(1) Clean all parts except the coil assembly in dry cleaning solvent.

NOTE

Do not wet the coil with solvent; instead, wipe it clean with a lint-free cloth.

(2) Visually check the valve and valve seat for wear, bonding failure, or corrosion. Replace, if necessary. The valve seat should have a minimum seat 0.015 inch (0.38 mm) wide (fig. 3-132).



TA 073815

Figure 3-132. Inspecting the Shutoff Valve.

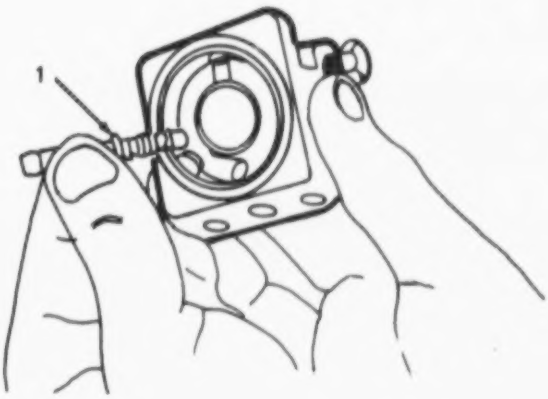
CAUTION

Be sure starting switch is in off position when checking coil.

(3) Check the coil assembly with a multimeter; replace if coil resistance is not 30 ± 2 ohms.

c. Assembly.

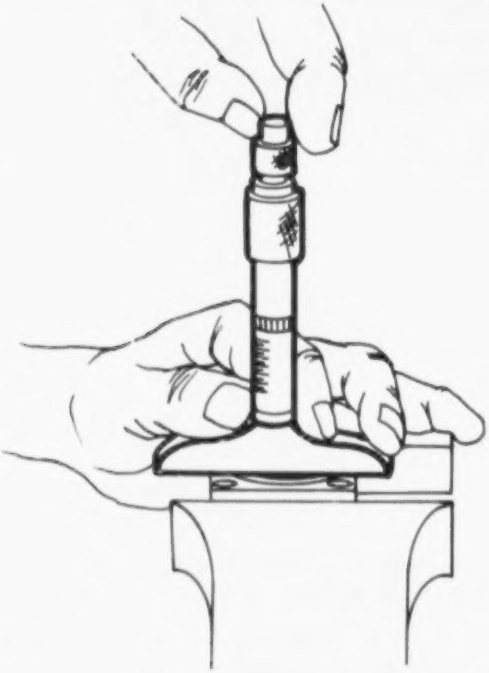
(1) Install a new O-ring (1) on new override shaft and coat with lubricant (fig. 3-133).



TA 073815

Figure 3-133. Installing the Override Shaft.

(2) Screw the shaft into the housing until it reaches the bottom of its bore. Use a depth micrometer set at 0.118 inch (2.997 mm) and check the distance from the face of the valve housing to the tip of the shaft. If necessary, screw the shaft out until it is 0.118 inch (2.997 mm) below the housing face. Without moving the shaft, press on the knob until it contacts the valve housing which will act as a stop (fig. 3-134).



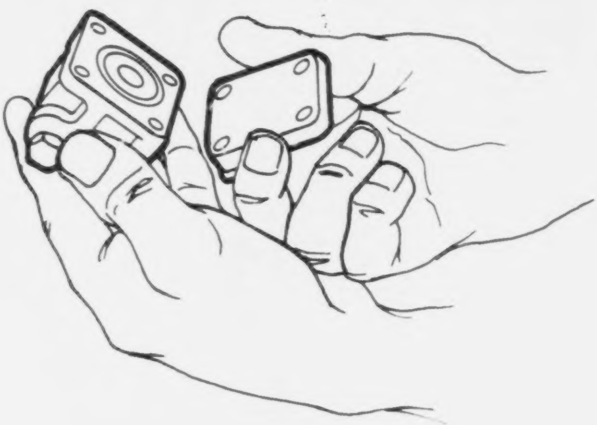
TA 073817

Figure 3-134. Checking the Shaft Tip Depth.

(3) Place the valve into the valve housing with a rubber side toward the housing.

(4) Apply lubricant to the housing O-ring (11, fig. 3-131) and seat in the groove.

(5) Drop the spring washer on the valve with the concave side up and piloted around the valve locator (fig. 3-135).



TA 073818

Figure 3-135. Assembling the Shutoff Valve.

(6) Place the fuel shield on the valve housing and tighten the screws to 25-30 lb-in (2.8 - 3.4 N·m) torque.

(7) Energize the valve and pump fluid through the valve at 300 psi (2068 kPa). De-energize the valve and the valve should withstand the 300 psi (2068 kPa) load with no leakage through valve.

(8) Should leakage exist, check the main body for nicks or depressions where the body and plate come in contact. Check the rubber seal in the plate for swelling or other defects.

3-99. Front Cover Assemblies. Front cover assemblies consist of the cover, main shaft and bearing, the governor weight carrier assembly, and tachometer drive. The cover is flange-mounted to the air compressor.

3-100. Disassembly and Inspection of Standard Cover.

a. Check the governor weight carrier shaft in its bushing before removal. Excessive wear can be felt by moving the shaft from side to side in the bushing.

b. Observe gear backlash between the weight shaft gear and drive gear. Normal backlash is 0.005-0.009 inch (0.13-0.23 mm).

NOTE

Remove the weight-assist plunger if not previously removed.

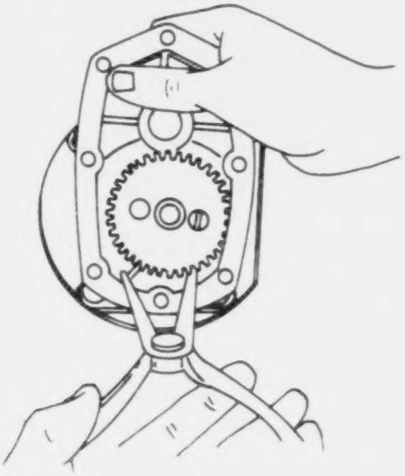
c. Remove the governor weight carrier assembly from the drive cover, using an internal engaging puller of ST-709 to pull the bushing. If the shaft pulls off the cast carrier, use ST-667 to remove the shaft and bushing. New assemblies do not have a snapring.

d. Remove the fuel pump drive coupling retainer capscrew and washers. Pull the coupling with an ST-709 puller if the cover contains the tachometer drive.

e. If the cover contains the tachometer shaft, remove the drive cover.

f. Use a brass punch to remove the tachometer shaft, seal and bushing from the front cover.

g. Remove the large snapring from the pump end of the drive shaft between the drive cover and drive gear with hose clamp pliers (fig. 3-136).



TA 073819

Figure 3-136. Removing the Snap Ring from the Groove.

h. Press the drive shaft oil seals from the drive cover.

i. The governor assembly can be disassembled to change the gear and bushing. If the bushing is worn larger than 0.504 inch (12.80 mm), replace bushing.

3-101. Governor Weight Carrier.

a. If the cast carrier shaft is removed from the carrier, press the shaft into the carrier until the end of the shaft is flush to 0.005 inch (0.13 mm) below the carrier surface (weight side).

NOTE

Do not reuse parts unless there is a minimum of 0.0005 inch (0.013 mm) interference fit between the shaft and the carrier.

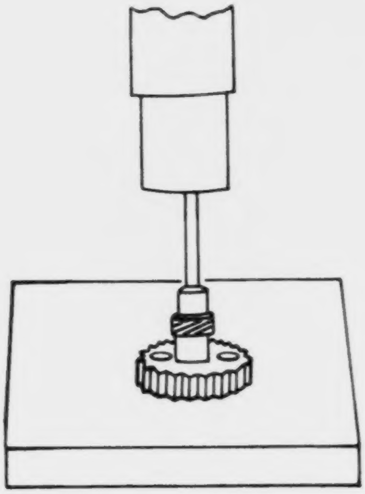
b. If removed, press on the gear. Do not press against the carrier as it may be damaged. Press against the inside end of the carrier shaft, if possible. The rough edge of the gear goes toward the carrier weight.

c. Slip the governor carrier bushing on the carrier shaft with the flanged end of the bushing next to the gear.

3-102. Drive Shaft.

a. Disassembly.

(1) Press the gear pump drive coupling and governor drive gear from the drive shaft (fig. 3-137).



TA 073820

Figure 3-137. Pressing the Shaft from Gears.

(2) Remove the front cover tachometer drive gear with a small gear puller and remove the key.

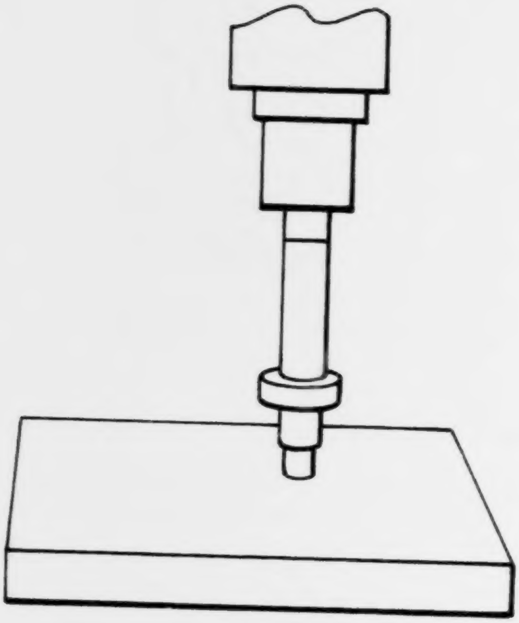
NOTE

Press away from the bearing because the shaft has a shoulder under bearing.

(3) Press the drive bearing from the shaft only if the bearing is rough or the shaft has worn grooves.

b. Assembly.

(1) If the bearing or shaft is replaced, lubricate the shaft with high-pressure lubricant and press the bearing over the shaft, pressing against the inner race of the bearing (fig. 3-138).



TA 073821

Figure 3-138. Pressing the Drive Bearing on the Shaft.

(2) Press the governor drive gear to the drive shaft bearing over the shaft.

(3) Lubricate the shaft and bore before pressing the gear pump drive coupling or rear tachometer drive gear on the shaft; press against the governor drive gear (fig. 3-139).

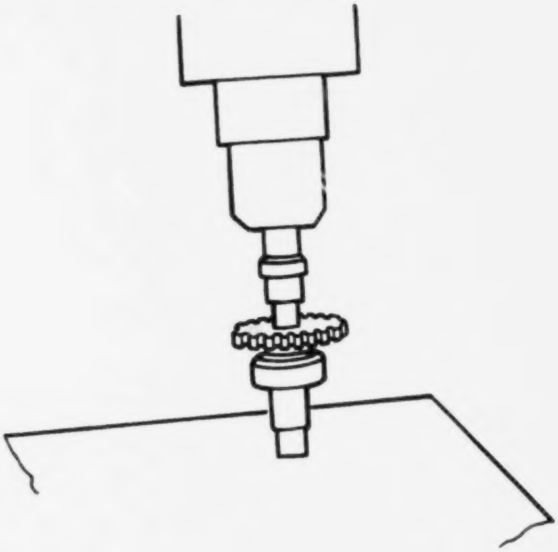


Figure 3-139. Pressing the Tachometer Gear on the Shaft.

NOTE

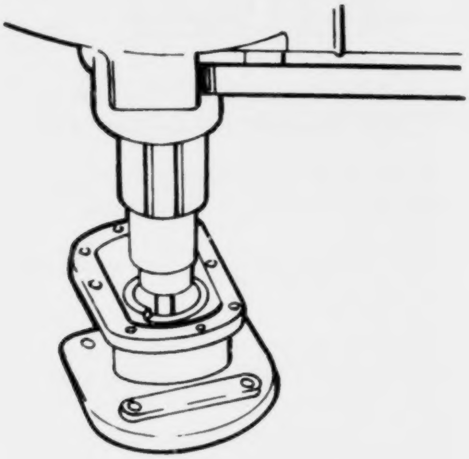
Check the gear to make sure it matches with the tachometer gear to give proper rotation.

(4) Check to see if the parts are firmly seated. Insert the snap ring between the ball bearing and governor drive gear.

3-103. Assembly of Cover with Tachometer Drive.

a. Clean all parts thoroughly with dry cleaning solvent.

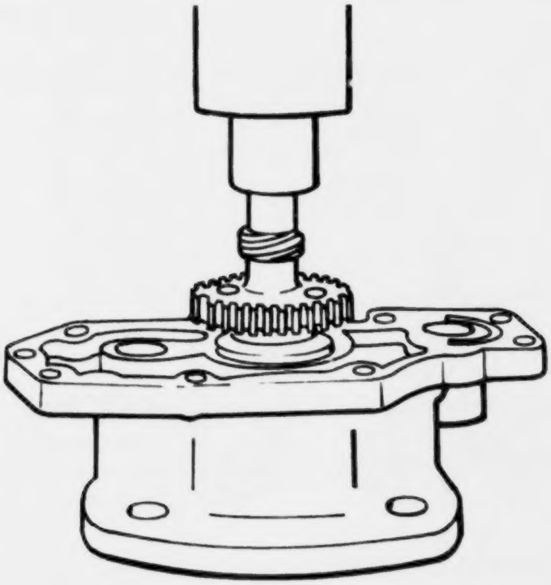
b. Press the first oil seal into the drive cover with lip toward the outside of the pump, and press the second oil seal into the drive cover with the sealing lip toward the inside of the fuel pump. Seals must be spaced so the "telltale" hole is not covered (fig. 3-140).



TA 073823

Figure 3-140. Installing the Drive Cover Oil Seal.

c. Using a suitable tool, place the snapring between the drive gear and bearing. Press the main shaft assembly into the front cover and through the seals (fig. 3-141).



TA 073824

Figure 3-141. Pressing the Drive Shaft Assembly into the Cover.

d. Line up the oil groove in the top of the tachometer drive bushing with the fuel pump drive shaft. Press the bushing, shaft and gear assembly into the cover until the bushing bottoms.

CAUTION

Do not overpress spacer. It can be flattened eliminating its effectiveness.

e. Install the spacer on top of the bushing with the slotted edge down. Install the new oil seal, with the spring side down. The spacer must bottom on the bushing.

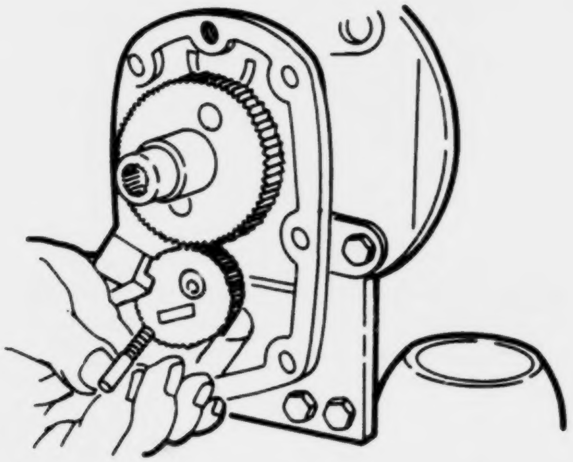
f. Cover the top of the seal with a thin coat of lubricating oil. Secure the tachometer housing to the cover.

g. Install the key, press the coupling and the front tachometer drive gear into position on drive shaft. Press slow and straight. Be certain tachometer gear teeth are alined.

h. Install the coupling retainer flatwasher, lockwasher and capscrew to the shaft and tighten in place. Hold the coupling or the main shaft in a copper-jawed vise while tightening.

i. Coat the governor-carrier bushing with high-pressure lubricant and press into the front cover. The bushing must seat against the housing. Slide the carrier assembly into the bushing. Rotate the weight assembly, with the weights opened out, to be sure it will turn completely in the housing.

j. Install the shims, when required, spring, and governor assist plunger between the governor weights and into the bore of the governor weight carrier shaft (fig. 3-142).



TA 073825

Figure 3-142. Installing the Weight-Assist Plunger in the Cast Weight Carrier.

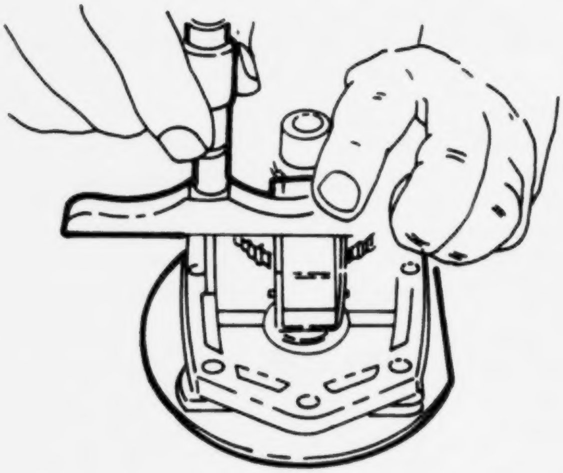
NOTE

Always check and assemble the weight assist plunger with the smallest end of the plunger to the weights. This will prevent the weight from sticking.

k. Use enough shims in back of the spring to make the governor assist plunger protrude above the gasket face of the front cover. Gage protrusion with a dial depth gage having a base approximately 4 inches long

3-104. Checking Protrusion with Depth Micrometer.

a. Place one leg on the depth micrometer base of the pedestal across the carrier walls and measure down to the front cover gasket surface (fig 3-143). Move the depth micrometer to the opposite side of the carrier and again measure to the front cover gasket surface directly across the cover from the previous measurement (do not turn carrier or cover). Average these two measurements. This procedure is necessary to eliminate any possible influence of uneven carrier wall heights.



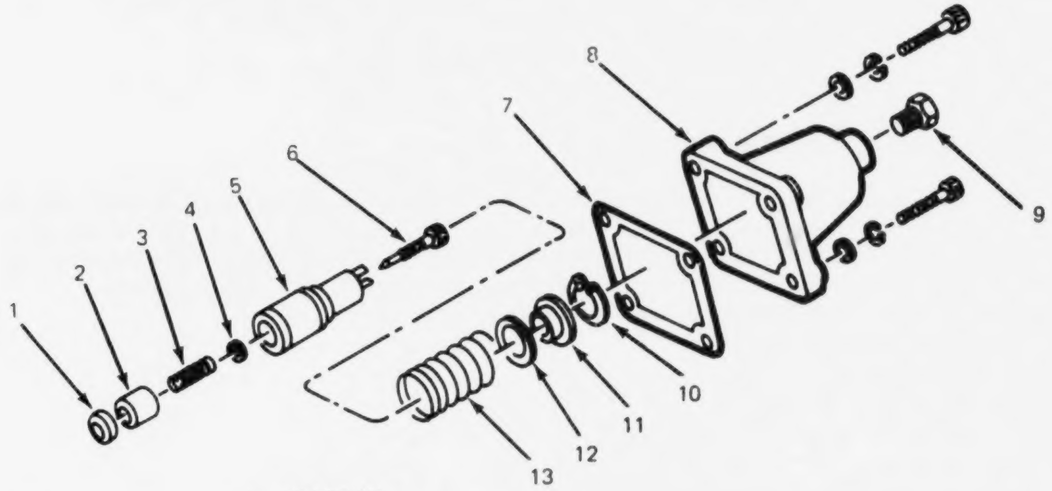
TA 073826

Figure 3-143. Measuring the Assist Plunger Protrusion.

b. Position the depth micrometer across the carrier directly over the weight-assist plunger. Measure down to the plunger. Do not depress spring.

c. Subtract measurement "B" from the average determined as measurement "A". The result is the weight-assist protrusion. If weight-assist protrusion is below 0.840 inch, add shims. If the weight-assist protrusion is above 0.840 inch, remove shims or grind the exposed end of the weight plunger (grind only if no shims are being used).

3-105. Governor Spring Pack. The governor spring pack consists of the idle and maximum or high-speed springs, plungers, adjusting screw and shims. The springs control engine speed and adjustments are made by the shims or adjusting screw (fig. 3-144).



1. ADAPTOR
2. IDLE SPRING PLUNGER
3. IDLE SPRING
4. WASHER, SPRING
5. GUIDE AND CLIP
6. ADJUSTING SCREW
7. GASKET
8. COVER
9. PLUG
10. RETAINING RING
11. RETAINER
12. SHIM
13. HI-SPEED SPRING

TA 073827

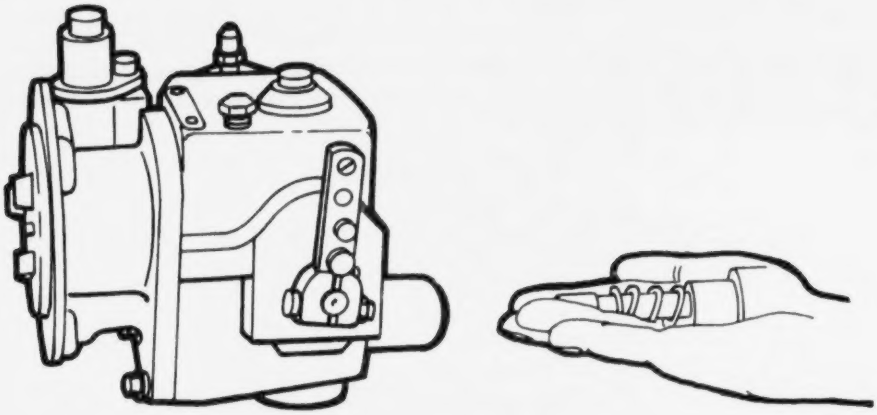
Figure 3-144. Governor Idle Control – Exploded View.

3-106. Spring Pack Disassembly.

a. Remove the retaining ring (10, fig. 3-144) which holds the governor spring pack in the sleeve with a pair of snap ring pliers.

b. Remove the high-speed spring (13), spring retainer (11) and shims (12) from the spring pack housing.

c. Remove the idle spring plunger guide, idle spring or springs, idle spring plunger, and spring washer (fig 3-145).



TA 073828

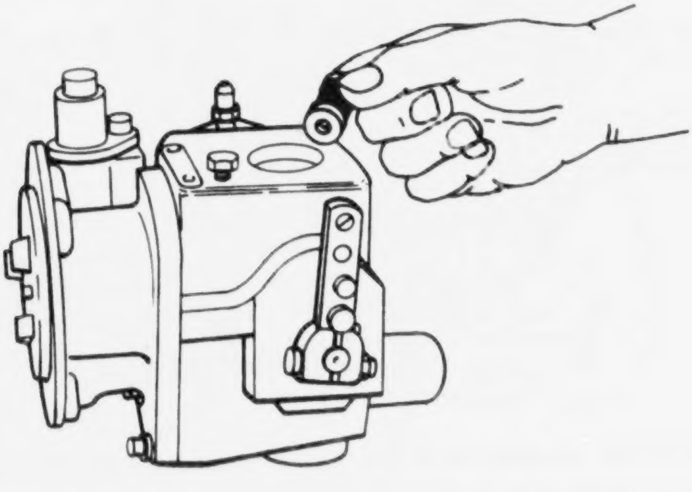
Figure 3-145. Removing the Spring Pack Assembly.

3-107. Fuel Pump Assembly. The pump assembly requires all parts to be dirt free, and the actual operations performed with the utmost care, to insure proper and trouble-free performance.

3-108. Vise and Holding Fixture. Mount the fuel pump on a suitable holding fixture and swivel vise.

3-109. Filter Screen.

a. Assemble the filter screen assembly into the top of the housing (the hole in the retainer faces down) (fig 3-146).



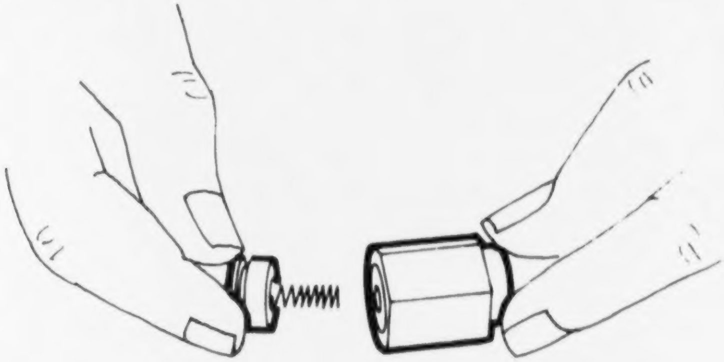
TA 073829

Figure 3-146. Installing the Filter Screen in the Housing.

b. Install the O-ring, using grease to hold it in place.

c. Position the spring and tighten the cover in place. Torque the cap to 8-12 lb-ft (11-16 N·m). Over-tightening is not necessary or desirable.

3-110. Governor Spring Pack. Assemble the idle screw into the plunger guide, place a small washer over the screw point inside the guide. Place the small idle spring into the guide and place the idle plunger (button) against the spring in the guide (fig 3-147).



TA 073830

Figure 3-147. Installing the Idle Plunger Button.

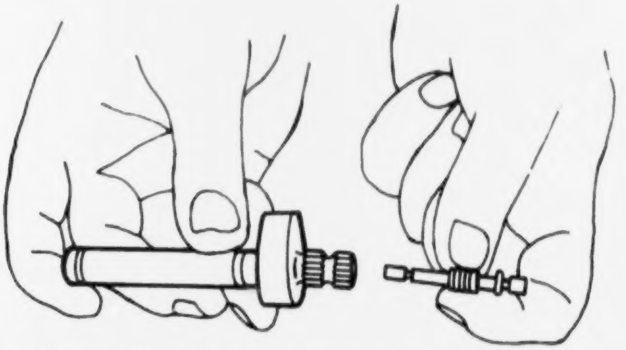
3-111. Throttle Shaft.

CAUTION

Throttle shafts may vary with application and are color coded. Replace same with same type shaft if needed.

a. Lubricate the O-ring and slide on a new fuel adjusting screw with screwdriver slot.

b. Insert the fuel adjusting screw into the throttle shaft about 6 turns. Do not restrict the throttle shaft fuel port (fig 3-148).



TA 073831

Figure 3-148. Installing the Fuel Adjusting Screw in the Throttle Shaft.

c. Lubricate the O-ring and slide it on the throttle shaft.

d. Install the throttle shaft with the control rod end facing up in the AFC pump.

e. Install the snapring on the end of the throttle shaft.

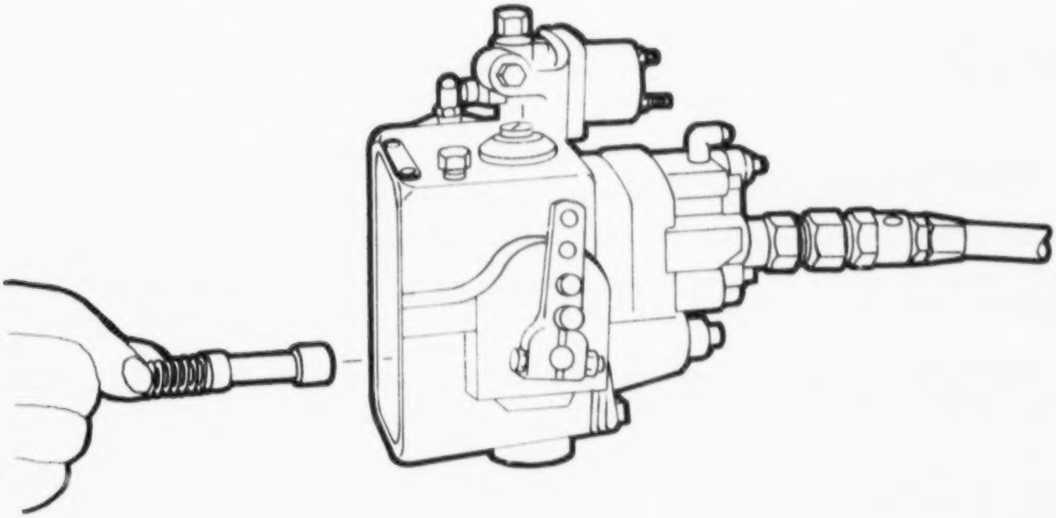
f. Install the ball in the throttle shaft, with Service Tool No. 3375204, after the pump has been calibrated.

3-112. Throttle Lever. Install the throttle lever on the throttle shaft and tighten securely. The spring-loaded throttle lever is used to prevent throttle shaft bushing wear and scoring that can occur when excessive pressure is applied to the throttle lever in the full fuel position. The spring-loaded lever is designed to collapse under this excessive pressure and then spring back when the pressure is released. This will also prevent the throttle lever from turning on the shaft and mutilating the serrated shaft diameter.

WARNING

The throttle lever stop in the vehicle chassis should be adjusted so there will be a minimum or negligible amount of collapsing of the throttle lever. Otherwise, the purpose of the spring-loaded lever will be defeated as the lever can collapse only so far. When the throttle linkage stop is not properly adjusted, the spring-loaded lever may permit the bell crank in the linkage mechanism to go "over center," locking the throttle in full fuel position.

3-113. Governor Plunger. Lubricate with engine oil and install the plunger into the barrel (fig 3-149). Make sure the plunger is a correct fit and change the number if replaced. Re-mark the governor barrel if an oversize plunger is used. The size of the barrel and the plunger must correspond.



TA 073832

Figure 3-149. Installing the Governor Plunger.

3-114. Drive Cover Assembly.

a. Place a new gasket over the pump housing dowel pins.

b. Place the assist plunger in the weight shaft bore with spring and shims, when required.

c. Hold the governor weights in to hold the assist plunger while assembling the cover to the housing.

d. Position the plunger drive tang horizontally. Position weight carrier horizontally.

NOTE

The weights straddle the governor plunger driver.

e. Torque the capscrews to 9-11 lb-ft (12-15 N·m) securing the cover to the housing.

3-115. Gear Pump.

a. Assemble the gear pump to the main housing using a new gasket. For right-hand rotation, locate the notch or ridge to the upper right-hand corner (looking from behind the fuel pump).

NOTE

Use the correct gasket and be sure it is positioned correctly. Be certain the housing fuel holes match the gear pump holes.

b. Torque the capscrews in increments to 11-13 lb-ft (15-18 N·m). Check for gear pump rotation freedom.

c. Install the fuel inlet elbow with same type threads as gear pump. Current gear pumps use a 3/4-inch 16 UNF threaded connection. Cover the connection to keep out dirt.

3-116. Shutoff Valve and Pulsation Damper.

a. Install the shutoff valve with new O-ring on the fuel pump housing.

b. Install the damper with a new O-ring to the gear pump. Torque the capscrews to 11-13 lb-ft (15-18 N·m). Check for gear pump rotation freedom.

3-117. Fuel Pump AFC Breather. Install the fuel pump AFC breather on the opening in top of fuel pump housing. Tighten to 5-8 lb-ft (7-11 N·m) torque.

3-118. Fuel Pump Test and Calibration.

a. General. The PT (Type G) AFC fuel pump is to be tested and calibrated on a fuel pump test stand. See figure 3-150 for identification of fuel pump major components.

b. Test Fuel. Fill fuel pump test stand with Gulf 45A calibrating fluid, NSN 6850-00-974-3788 (55 gal) or diesel fuel, MIL-F-45121 (CIE).

c. Calibration Data. (See Table 3-8).

3-119. Check Pump Nameplate. Make sure the fuel pump nameplate properly describes the fuel pump to be calibrated (Fig. 3-151).

a. The first item in the top line is Control Part List: 0324.

b. The next four spaces show the Base Fuel Pump Code: 3385.

c. The next eight spaces give the fuel pump Serial Number: 99999999A.

d. The first space on the bottom line is for rotation. Right hand rotation pumps will not be stamped.

e. The next seven spaces on the bottom line show the Fuel Pump Assembly Number: 3004188.

f. The last five spaces on the bottom line give the Engine Shop Order Number: 98451.

3-120. Precalibration Tests Prior to Mounting. Housing Porosity and Leakage Check.

a. Fill fuel pump with clean diesel fuel through case fill plug.

b. Install fuel filter adapter, testing plate.

c. Install suitable air fitting to fuel filter adapter testing plate to facilitate attaching 20-psi air pressure hose.

d. Apply 20 psi air pressure to fitting.

e. Pour fuel over pump and examine for leaks indicated by air bubbles.

f. Wipe pump dry, and check for seepage of fuel oil from inside pump.

g. If either type of leak is evident, the fuel pump housing must be replaced.

h. Remove air hose and air fitting. If pump housing is to be replaced, also remove the fuel filter adapter test plate.

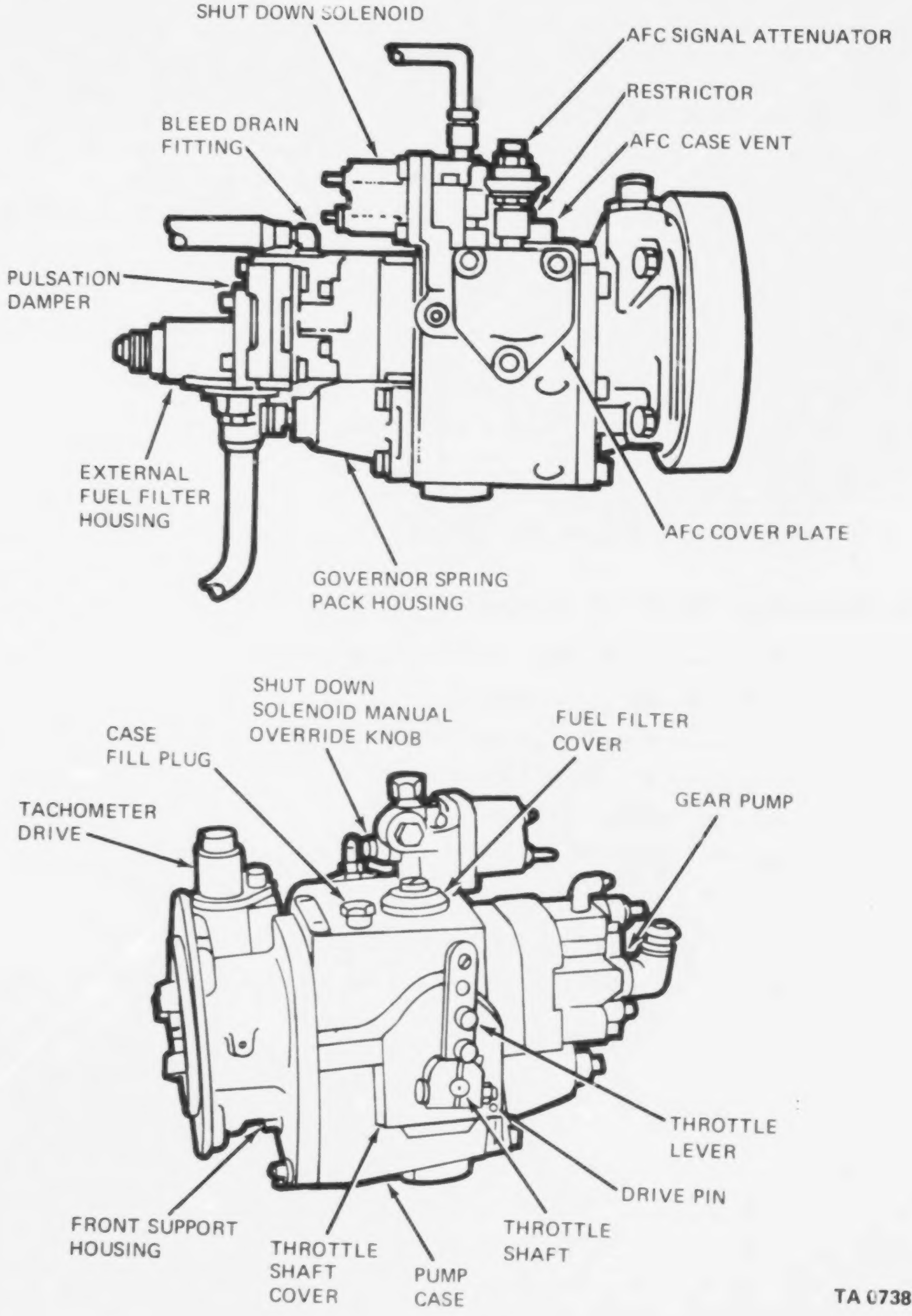
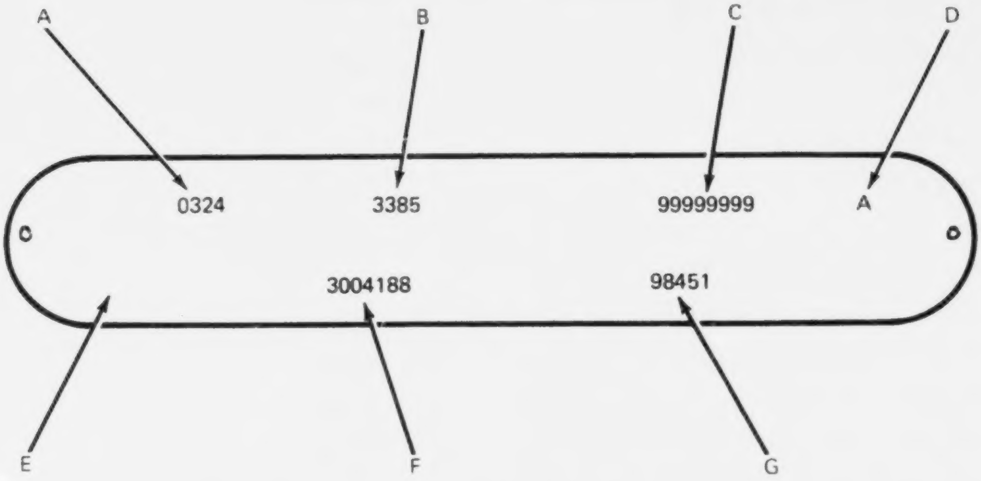

SHUT DOWN SOLENOID
AFC SIGNAL ATTENUATOR
RESTRICTOR
BLEED DRAIN FITTING
AFC CASE VENT
PULSATION DAMPER
EXTERNAL FUEL FILTER HOUSING
AFC COVER PLATE
GOVERNOR SPRING PACK HOUSING
SHUT DOWN SOLENOID MANUAL OVERRIDE KNOB
CASE FILL PLUG
FUEL FILTER COVER
GEAR PUMP
TACHOMETER DRIVE
THROTTLE LEVER
DRIVE PIN
FRONT SUPPORT HOUSING
THROTTLE SHAFT
THROTTLE SHAFT COVER
PUMP CASE
TA 073833

Figure 3-150. Fuel Pump Components.

Table 3-8. Calibration Values: PTG-AFC Fuel Pump.

Pump Code; Date; CPL	3385-A; 9-77; 0324
	3449; 4-78
Test Hp Rated RPM	400 @ 2100
Engine Fuel PSI	152-168
Fuel Rate lb/hr	144-150
Auto Governor Cutoff RPM	2130-2150
Throttle Leakage cc/1000 RPM	12½-16½
Throttle Travel Degrees	27-29
Idle Speed PSI @ RPM	40 @ 500
Idle Speed AFC Mfd. Press Inches HG	40-48
Calibration PSI @ RPM (Flow)	159 @ 2100 (440)
Check Point 1	
PSI @ RPM (Flow)	121-127 @ 1500 (385)
Check Point 2	
PSI @ RPM (Flow)	71-77 @ 1000 (285)
AFC Setting	
In-Hg @ RPM	42 @ 1600
Fuel PSI, Flow	64;264 64
No-Air Set RPM (PSI) Flow	1600 (40) 213
Weight Assist Setting	0.900 Inch
Weight Assist Spring P/N	143847
Idle Plunger Code and P/N	40-141633
Idle Spring	144195
Torque Spring P/N	138784
Torque Spring Shims	(0.005) 101841
	(0.010) 101842
	(0.020) 101843
Governor Weight P/N	146437
Governor Spring P/N	143252
AFC Spring P/N	179834



A CONTROL PARTS LIST
B FUEL PUMP CODE
C PUMP SERIAL NUMBER
D LATEST CODE REVISION
E PUMP ROTATION (BLANK FOR THIS ENGINE)
F PUMP ASSEMBLY
G ENGINE SHOP ORDER NUMBER

TA 073834

Figure 3-151. Fuel Pump Nameplate.

3-121. Mounting Fuel Pump.

CAUTION

Never operate gear pump having cooling drain with the drain plugged.

NOTE

Never remove the fuel pressure damper during either testing or operation as it will cause erratic pump performance and accelerate wear.

a. The throttle shaft cover should have been removed during repair. On fuel pumps that are only being calibrated, remove the throttle shaft cover. This is necessary to gain access to the no air adjustment screw underneath the throttle shaft cover. Adjustment of the no-air adjustment screw is necessary for proper calibration of the fuel pump. The throttle shaft cover is removed as follows:

(1) Carefully centerpunch each of the two drive pins retaining the throttle shaft cover. Use care to prevent damage to the pump housing.

(2) Drill out the heads of the drive pins with a 5/64-inch drill bit.

(3) Drill until the bit is through the head of the drive pin.

(4) Loosen nut and remove throttle shaft lever.

(5) Use a small cold chisel and small hammer to tap off each drive pin head. Remove throttle shaft cover.

(6) Install throttle shaft lever and tighten nut.

b. Mount adapter ring assembly (2, fig 3-152) to adapter bracket (1) and secure with four capscrews and plain washers.

NOTE

"TOP" or part number on adapter ring must be at top.

c. Place ring and adapter assembly on stand mounting rails and secure to rails with clamp bar. Finger tighten clamp bar only.

d. Mount pump on adapter ring and bracket assembly and secure with four capscrews and plain washers.

e. Reposition throttle shaft to full open position towards the test stand, 180° on engine position, and retain by connecting a spring between the throttle lever and adapter ring assembly.

f. Place coupling insert (3) into test stand drive shaft coupling.

g. Loosen bar clamp and slide pump and bracket assembly to engage stand drive shaft. Allow 1/16-inch end clearance between pump drive and stand drive. Tighten bar clamp screw securely.

NOTE

Lubricate front tachometer drive gears in the front cover to protect them from excessive wear during calibration.

h. Install fuel filter adapter plate, if not already installed. Install pump inlet adapter (5) to fuel filter adapter. See figure 3-153 for diagram of pump hookup.

i. Connect 1/2-inch ID flexible hose (11, fig 3-152) from stand suction control valve to flare connector of inlet adapter assembly on pump.

j. Plug primer pressure outlet on test stand bed.

k. Install a 1/2-inch ID flexible bypass hose (11) from stand Lube Oil Pressure to stand Lube Oil Return.

l. Connect 1/4-inch flexible hose to No. 2 vacuum gage and inlet connector to pump inlet adapter.

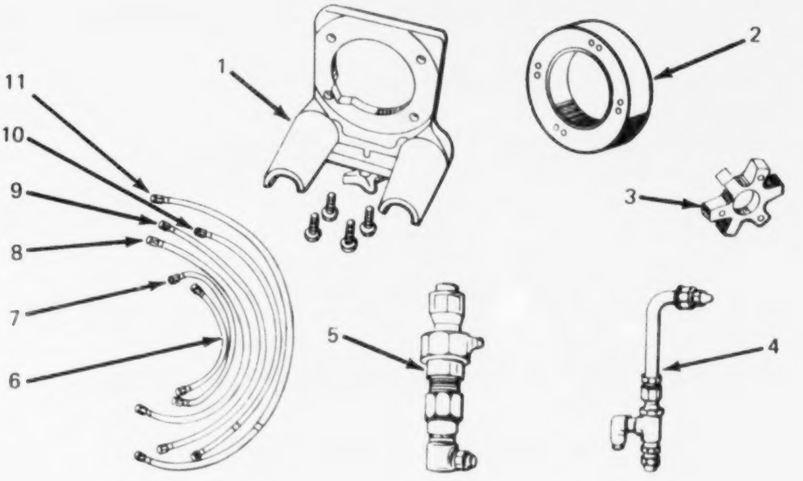
m. Install pump discharge fitting assembly (4) to fuel pump shutoff solenoid valve.

n. Install flexible hose (10) from stand Pressure Gage outlet to pump discharge fitting.

o. Install flexible hose (9) from stand Fuel Input connection to pump discharge fitting.

p. Install 1/2-inch ID flexible hose (8) from stand Fuel Outlet connector to stand Fuel Return connector.

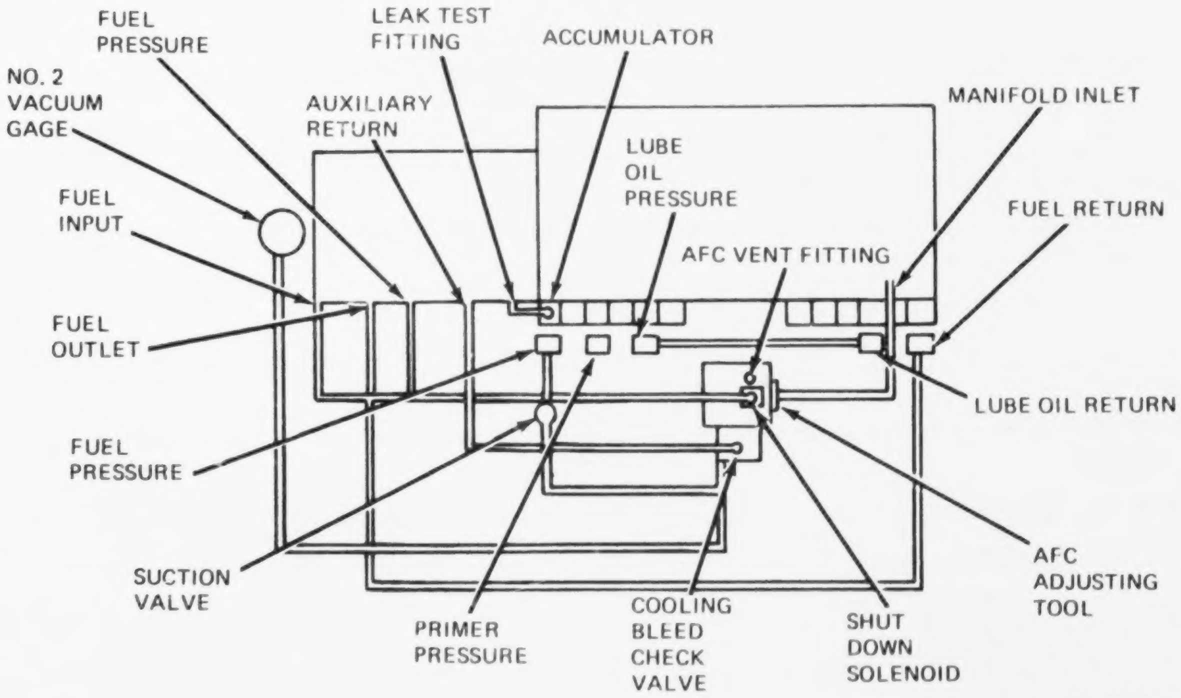
q. Install flexible hose from stand Leak Test connector to No. 1 accumulator. Connect 1/4-inch flexible hose (6) from the cooling bleed check valve pump to Auxiliary Return on test stand.


11
10
9
8
7
6
1
2
3
5
4

1. ADAPTER BRACKET
2. ADAPTER RING ASSEMBLY
3. COUPLING INSERT
4. DISCHARGE FITTING ASSEMBLY
5. INLET ADAPTER ASSEMBLY
6. LEAKAGE ACCUMULATOR HOSE
7. FUEL MANIFOLD HOSE
8. FUEL SUCTION HOSE
9. FUEL INPUT HOSE
10. FUEL PRESSURE HOSE
11. FUEL RETURN HOSE

TA 073835

Figure 3-152. Fuel Pump Test Stand Equipment.


FUEL PRESSURE
LEAK TEST FITTING
ACCUMULATOR
NO. 2 VACUUM GAGE
AUXILIARY RETURN
MANIFOLD INLET
LUBE OIL PRESSURE
FUEL INPUT
FUEL RETURN
AFC VENT FITTING
FUEL OUTLET
LUBE OIL RETURN
FUEL PRESSURE
SUCTION VALVE
AFC ADJUSTING TOOL
PRIMER PRESSURE
COOLING BLEED CHECK VALVE
SHUT DOWN SOLENOID

TA 073836

Figure 3-153. Fuel Pump Hookup Diagram.

r. Install a suitable spring pack adjusting tool into governor spring pack housing. See figure 3-154.

s. Remove AFC cover plate with Air Signal Attenuator and Restrictor, and install a suitable AFC Adjusting Tool in its place. Pull out knobs on tool to disengage sockets. The relief cuts on the AFC Adjusting Tool face the rear of the pump to allow clearance for the pipe plug for the AFC fuel passage. See figure 3-155.

t. Install a flexible hose from the manifold inlet on the stand to the AFC adjusting tool.

NOTE

The drive belt on the auxiliary motor must be disengaged to disconnect the test stand fuel and lube pumps. These pumps are not required for testing the PTG-AFC fuel pump. The auxiliary motor is needed to drive the vacuum pump. Loosen the two belt tension plate bolts holding the lube and fuel pumps to disengage the drive belt. See figure 3-156.

u. Loosen drive belt on test stand auxiliary motor and secure in a position so it will not be damaged.

v. Air Signal Attenuator (ASA) and Restrictor.

(1) ASA

(a) The ASA is a non-adjustable auxiliary noise and smoke control valve, primarily used for noise control which results in a reduction in acceleration smoke. Calibrate the fuel pump without the valve. This valve is threaded into the AFC cover plate. This valve produces a delay in the intake manifold pressure signal to the AFC. See figure 3-157.

CAUTION

When removing the ASA from the AFC cover plate, do not disassemble by placing the wrench on top of the ASA. Place the wrench on the hex at the bottom of the ASA, just above the top of the restrictor for disassembly.

(b) An internal, porous metal filter protects the ASA from contamination. The valve can be checked by blowing through each side of the valve; there should be free air flow when blowing through the 1/8 NPT end of the valve (AFC cover plate end) and restricted flow when blowing through the intake manifold end (almost no air flow).

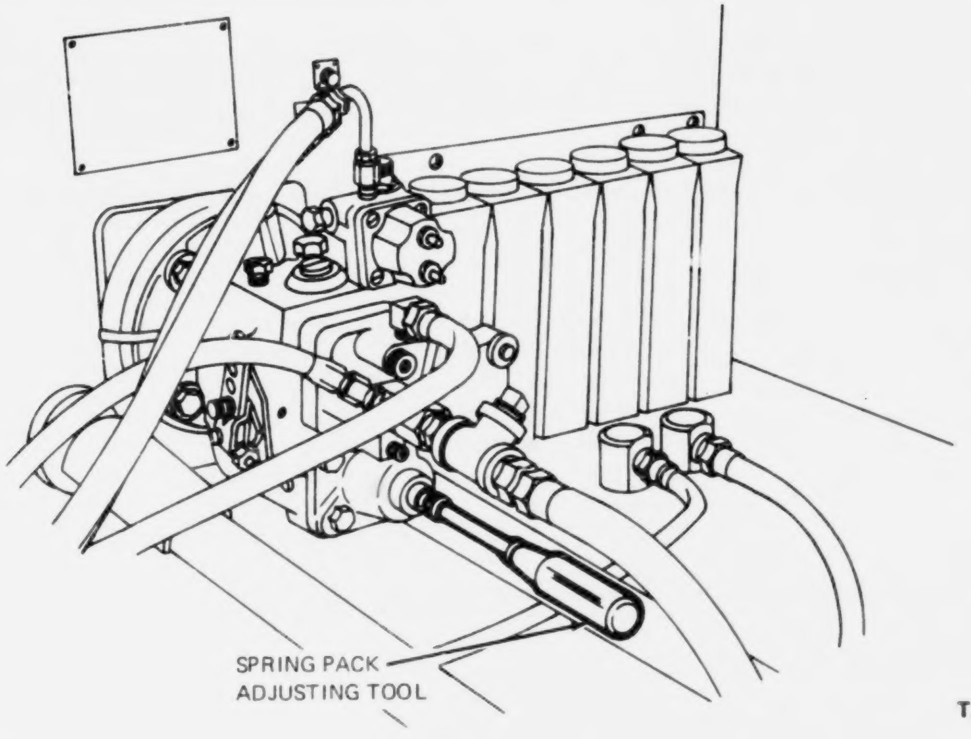

SPRING PACK
ADJUSTING TOOL
TA 073837

Figure 3-154. Adjusting Governor Spring Pack.

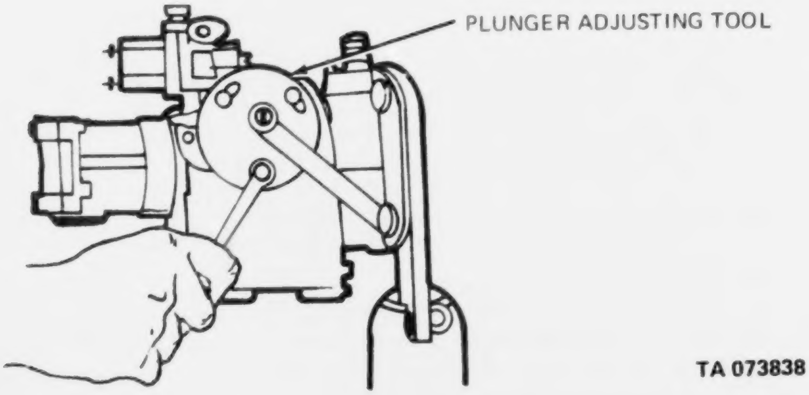
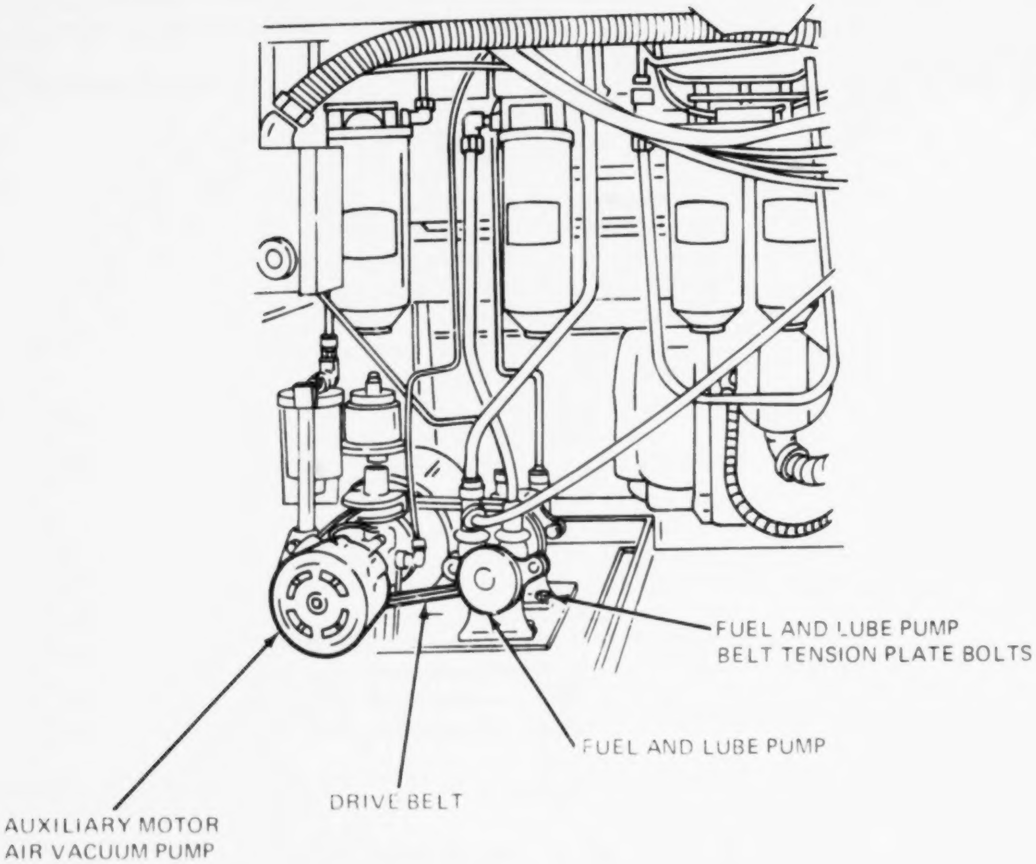
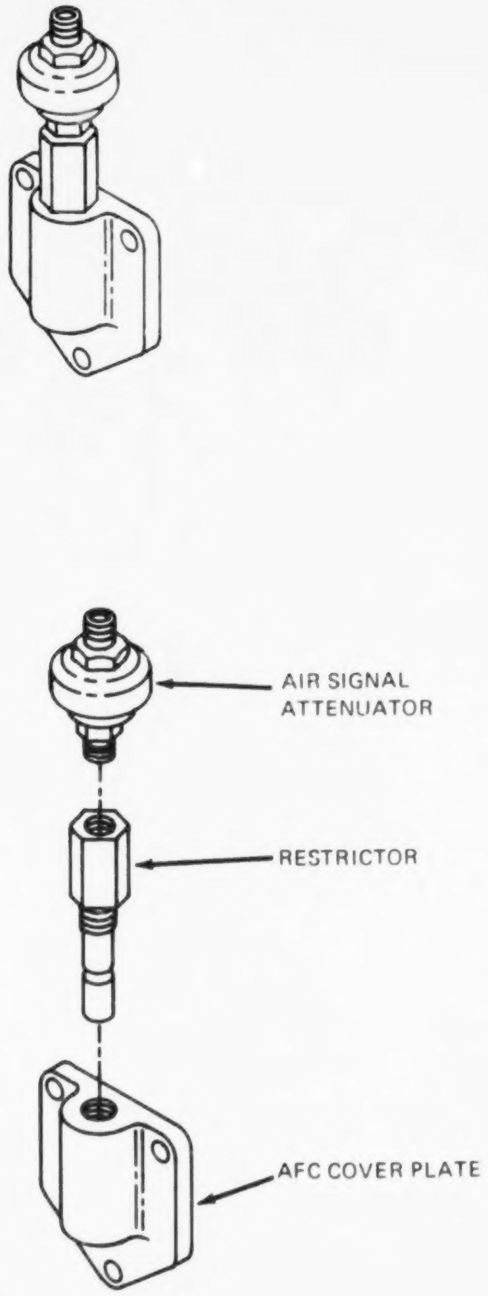

PLUNGER ADJUSTING TOOL
TA 073838

Figure 3-155. Installing Plunger Adjusting Tool on an AFC Fuel Pump.


FUEL AND LUBE PUMP
BELT TENSION PLATE BOLTS
FUEL AND LUBE PUMP
DRIVE BELT
AUXILIARY MOTOR
AIR VACUUM PUMP

TA 073917

Figure 3-156. Drive Belt Location.


AIR SIGNAL ATTENUATOR
RESTRICTOR
AFC COVER PLATE

TA 073839

Figure 3-157. Air Signal Attenuator and Restrictor.

(2) Restrictor

(a) The restrictor aids the ASA in delaying the intake manifold pressure to the AFC. In addition, a check ball is located in the restrictor to prevent a reverse fuel flow to the intake manifold if the AFC bellows ruptures.

(b) Check the restrictor check ball for sticking by shaking it and listening for the check ball to rattle in the restrictor. If the check ball is stuck and not moving when the restrictor is shaken, replace the unit. Check the restrictor orifice by connecting it to an air line. Immerse the restrictor in clean test fluid and pressurize it with 10 psi air pressure. If no air bubbles are coming out of the orifice, the restrictor is plugged or contaminated and should be replaced.

3-122. Fuel Pump Run-In.

CAUTION

Test stand motor switch is marked "REVERSE" and "FORWARD". For all testing of this fuel pump, the stand switch must be set to the "REVERSE" position. This corresponds to the right-hand rotation requirements for this fuel pump. If the motor switch is in the incorrect position, the pump will run dry, and could be damaged.

Be certain the fuel pump screen and magnet are clean, and fuel filter is installed correctly. Foreign material in pump could damage seals, gears, and shafts, and plug fuel passages. Check to see that fuel filter is installed with hole in filter at the bottom. If the filter is installed upside down, it will cut off all fuel flow to pump. The pump will run dry, and could be damaged.

NOTE

For a complete description and location of the test stand controls, refer to TM9-4910-387-14 & P, Tester, Fuel Injection: Single End Drive, 150 to 3,000 RPM.

a. Open pump solenoid manual override by turning knob clockwise. (See Figure 3-158).

b. Open stand BYPASS VALVE, SUCTION VALVE, AND FLOW CONTROL VALVE. Back seat all other valves on stand to prevent leakage.

c. Set speed shifting crank to HIGH RANGE.

d. Make sure throttle is in wide open position and secured with spring.

e. Turn selector valve to ROTAMETER position.

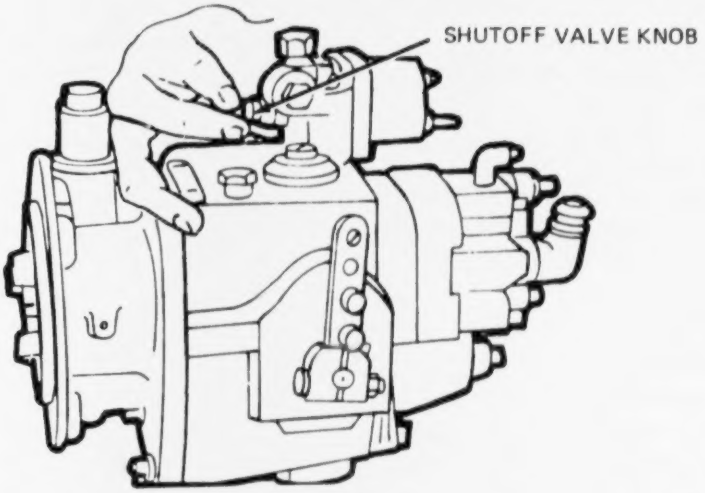


Figure 3-158. Opening the Shutoff Valve.

f. Set manifold selector valve to MANIFOLD PRESSURE position.

g. Set vacuum-pressure selector valve to PRESSURE position.

h. Turn on external power source to stand.

i. Turn on FUEL HEAT SWITCH, and observe that the fuel temperature on FUEL TEMPERATURE GAGE is between 120° to 130°F for Gulf 45A calibrating oil (80° to 100°F for diesel fuel). Periodically check the fuel temperature, and turn FUEL HEAT SWITCH on and off as required to maintain proper fuel temperatures.

j. Start test stand by depressing START button. Depress and release FAST and SLOW buttons as necessary until 500 rpm is indicated on stand tachometer.

k. Turn auxiliary motor switch to ON to start vacuum pump on stand.

l. Turn the vacuum-pressure selector valve to PRESSURE, and turn the pressure regulator knob to obtain 40-48 inches Hg (mercury) of absolute pressure on the manifold vacuum pressure gage. This will provide air pressure to the AFC bellows and plunger during this test.

m. If pump is newly rebuilt or has been disassembled and assembled, run it at 200 rpm for 5 minutes to flush, allow bearings and seals to seat, and to purge air from system.

NOTE

Close bypass valve and check rotameter for air in fuel flow. If air bubbles are present, work pump throttle lever from full open to idle several times, to relieve any entrapped air in pump. If the air bubbles persist, it is an indication of an air leak in the system. Turn stand off and check the line connections between tank and pump tightness, mating of gear pump to housing, or that the fuel supply tank is full.

n. At 500 rpm, the gear pump must pick up fluid at this speed without the aid of priming. If no fluid pick up is indicated in the ROTAMETER, check fuel filter for improper installation, stand motor switch for correct rotation, SUCTION VALVE open, hose connections, and gear pump for condition.

3-123. Calibration Procedures.

a. Pump Seal and Housing Porosity Check.

(1) With test stand operating at 500 rpm (throttle wide open), make sure that the BYPASS VALVE is closed and the FUEL FLOW VALVE is open.

(2) Close the SUCTION VALVE in the fuel pump suction line. The No. 2 VACUUM GAGE should read 15 inches Hg vacuum. If 15 inches Hg is not obtained, check all test hose connections. If 15 inches Hg is still not obtained, turn off stand and check for housing porosity.

CAUTION

Do not pressurize pump housing in excess of 15 psi.

(a) Attach a low pressure air line to the fuel inlet fitting.

(b) Pressurize the housing for 3-5 psi, and pour clean test fuel over the pump and look for fuel leaks in governor housing, bottom of pump, gear pump, and front seal.

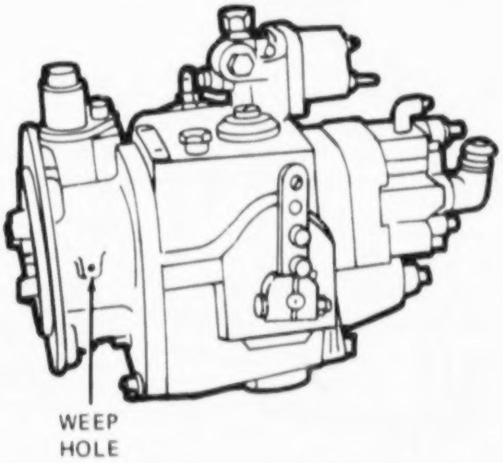
(c) If no leaks are evident, pour clean test fuel over the pump and look for air bubbles indicating a leak. Correct any problem before proceeding.

(3) Remove the pipe plug in the "weep" hole, if equipped. Clean the hole of dirt and other material.

(4) Put a small amount of light cup grease or lubricate over the "weep" hole at main shaft seal bore of the fuel pump front cover. See figure 3-159.

(5) If the grease is sucked into the hole at the 15 inches Hg setting, it is an indication that the seal will not permit proper fuel pump performance, and should be replaced.

(6) Remove tachometer cap and fill the tachometer seal bore with clean test fuel from test stand. If the fuel is drawn into the pump, the seal is defective, and should be replaced.



TA 072841

Figure 3-159. Checking the "Weep" Hole for Leakage

b. *Adjust Vacuum.*

(1) Open test stand FUEL FLOW CONTROL VALVE completely.

(2) Increase pump speed to 2000 rpm.

(3) Adjust SUCTION VALVE in fuel pump suction line to obtain eight inches Hg on No. 2 VACUUM GAGE. Once this setting is obtained, maintain it for all calibration procedures.

c. *Set Governor Cutoff RPM*

(1) With the pump running on the stand at 5000 rpm, open the FUEL FLOW CONTROL VALVE, and put the SELECTOR VALVE in ROTAMETER position.

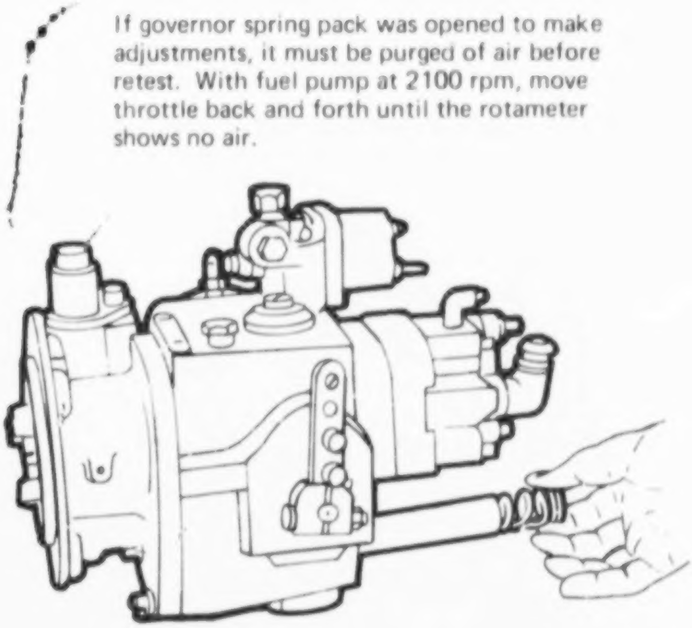
(2) Make sure throttle is in wide open position and retained with spring.

(3) Increase pump speed until the fuel pressure drops one psi in fuel pressure. Note stand tachometer; rpm should be between 2130 to 2150 rpm when fuel pressure begins to drop.

(4) If cutoff rpm is too high check to see if the spring pack adjustment tool is inserted too far. If the tool is correctly inserted, remove shims between governor spring and spring retainer. If cutoff rpm is too low, add shims between governor springs and retainer. Each .001 inch shim thickness will change speed approximately two rpm. Shims are available in .005, .010, and .020 inch thickness. See figure 3-160.

NOTE

If governor spring pack was opened to make adjustments, it must be purged of air before retest. With fuel pump at 2100 rpm, move throttle back and forth until the rotameter shows no air.



TA 073842

Figure 3-160. Shimming the High-Speed Governor Spring.

d. Set Throttle Leakage

NOTE

This setting is important since it controls the deceleration time of the engine.

(1) Set 40-48 inches Hg absolute pressure to AFC plunger and bellows.

(2) Set pump speed up to 2100 rpm.

(3) Set selector valve to ROTAMETER position, and set fuel flow control valve for 440 pph reading.

(4) Set SELECTOR VALVE to LEAKAGE TEST.

(5) Turn count selector switch to the 1000 position. Fuel flow for 1000 rpm will be taken.

(6) Pull out DUMPING LEVER to retain fuel in the number one BURETTE

CAUTION

Do not hold throttle lever in idle position any longer than necessary to complete test. Pump may overheat since fuel flow is used to cool and lubricate pump.

(7) Move the throttle lever to idle, and press COUNT START button to fill BURETTE. When BURETTE is full, push DUMPING LEVER in. Operating the count selector for one cycle before measuring wets the BURETTE, and a more accurate reading is possible.

(8) Move the throttle lever to idle position. Hold momentarily before depressing count button.

(9) Depress count start button to fill BURETTE.

(10) At end of cycle, read the amount of fuel left with the scale on the BURETTE. Normal fuel delivery is 12-1/2 to 16-1/2 cc for 1000 rpm.

(11) Check throttle leakage with a light and heavy lever load. If leakage is decreased by additional pressure in the throttle closed position, set the leakage under these conditions.

(12) If throttle leakage is not as specified, then adjust in or out as required. Backing the screw out will decrease throttle leakage, and moving the screw in will increase it.

e. Set Idle Speed.

(1) Set SELECTOR VALVE to IDLE position. Set 40-48 inches Hg on MANIFOLD VACUUM-PRESSURE GAGE to AFC Adjusting Tool using PRESSURE REGULATOR knob.

(2) Run pump at 500 rpm.

CAUTION

Do not hold throttle lever in idle position any longer than necessary to complete test. Pump may overheat since fuel flow is used to cool and lubricate pump.

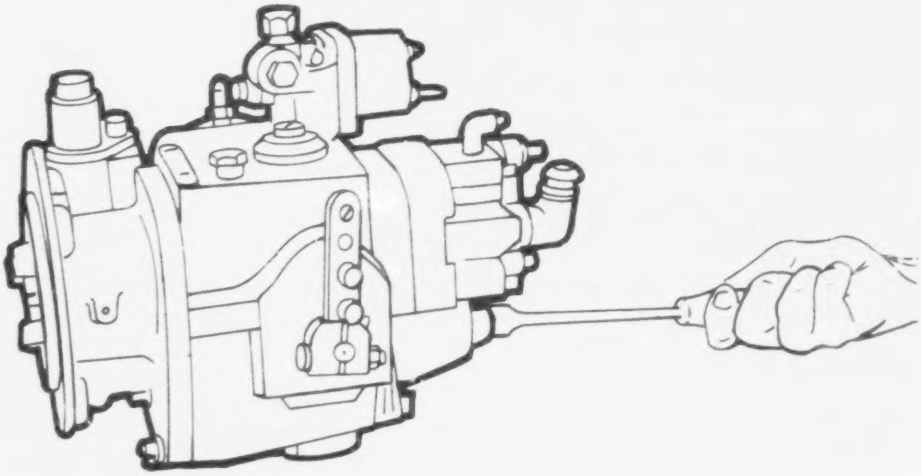
(3) Hold throttle in idle position. Pressure on FUEL PRESSURE GAGE should read **38-44 psi.**

(4) If the fuel pressure is incorrect, adjust idle adjusting screw using a suitable idle adjusting tool. If pressure is low, and the adjusting screw bottoms on guide, stop the test stand and add washers to the spring end of the screw. See figure 3-161.

NOTE

Each time governor spring pack housing or adjusting tool is removed, run pump until purged of air.

(5) After proper adjustment, stop test stand and remove adjusting tool. Install the pipe plug in the governor spring pack housing, and rerun stand to purge pump of air. Turn the stand off for the next step, throttle lever adjustment.



TA 073843

Figure 3-161. Adjusting the Lower Governor Idle Speed

(f) Throttle Lever Travel.

(1) Check throttle lever travel using tool 3375355, Throttle Lever Travel Template.

(2) The Throttle Lever Travel Template has two sets of matched holes for lever alinement that may be used. The first and third holes, moving clockwise from MAX to IDLE on the template, will set lever travel for 27-29° movement. The second and fourth holes, moving clockwise from MAX to IDLE will also set lever travel for 27-29° movement. Either set of holes may be used, but do not use the first and last hole in combination or the second and third holes; otherwise an erroneous reading will result. See figure 3-162.

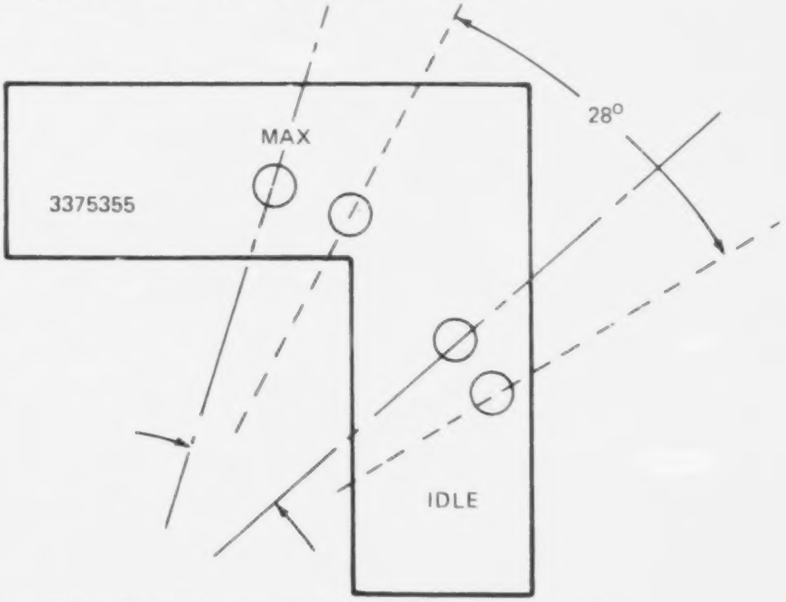
(3) Position the template on the fuel pump housing as shown in figure 3-163.

NOTE

Do not adjust rear throttle screw from valve set under throttle leakage. The rear throttle screw has already been set to provide the proper deceleration time for the engine, and any changes at this point will require recalibration of throttle leakage.

(4) Move the throttle lever to idle position, and line up the hole on the throttle shaft lever with the idle hole on the template. The throttle shaft lever may be repositioned on the throttle shaft as required to line up the holes.

(5) Move the throttle lever to full throttle position, and line up the hole on the throttle lever with the appropriate MAX hole on the template. If throttle lever travel is not correct, loosen the jamnut and adjust the front throttle stop screw to line up the holes. See figure 3-164.



SPECIAL TOOL 3375355 THROTTLE LEVER TRAVEL TEMPLATE

NOTE: Either set of holes in tool may be used to set 27-29° throttle lever travel, but the correct front and rear corresponding holes must be used.

TA 073844

Figure 3-162. Special Tool 3375355 Throttle Lever Travel Template

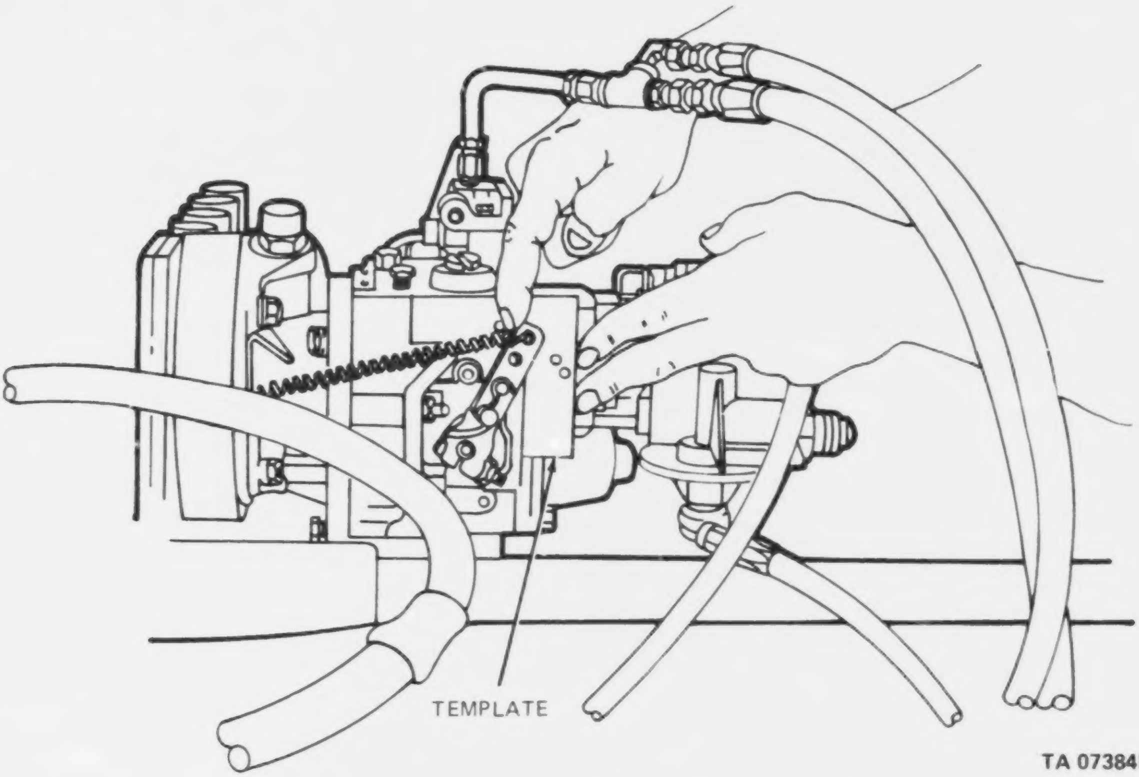

TEMPLATE
TA 073845

Figure 3-163. Position Template on Fuel Pump Housing.

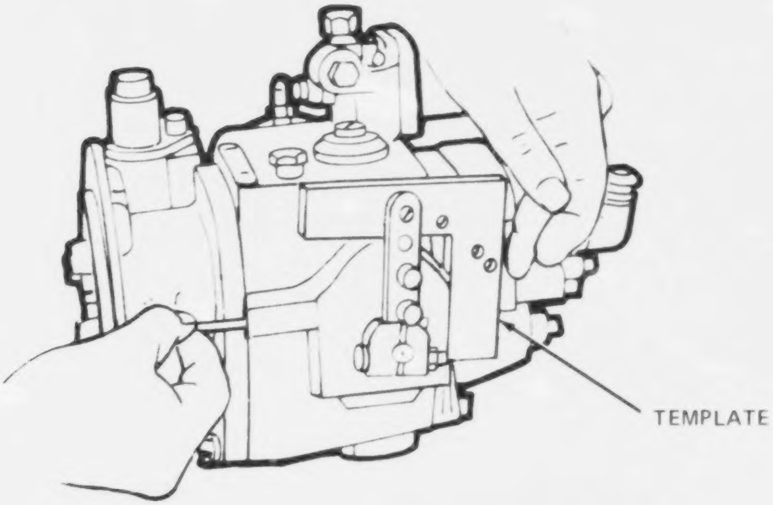

TEMPLATE
TA 073846

Figure 3-164. Adjusting the Front Throttle Stop Screw to Set Throttle Travel.

(6) After proper adjustment, lock the front throttle stop screw with the jamnut. The throttle lever may be repositioned to accommodate the throttle linkage.

g. Main Pressure.

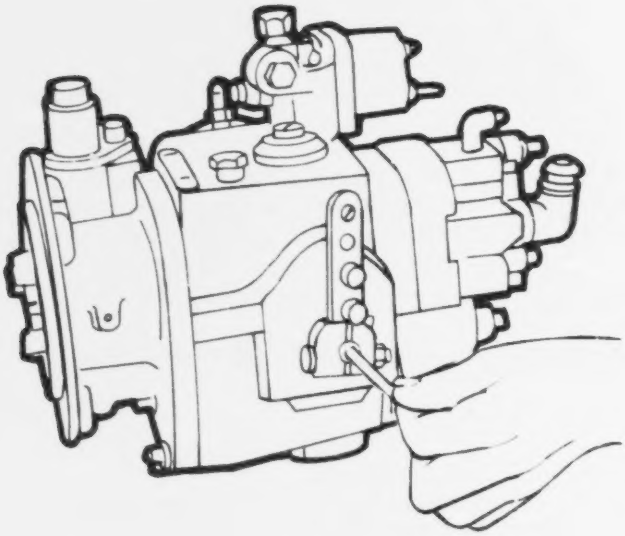
(1) Start test stand and run pump at 2100 rpm. Turn the SELECTOR VALVE to ROTAMETER position. Adjust fuel flow to 500 pph with the FUEL FLOW CONTROL VALVE. Set 40-48 inches Hg of air pressure to the AFC adjusting tool.

(2) Read the fuel pressure; it should be 153-157 psi.

NOTE

The throttle shaft internal adjusting screw is covered by a soft steel ball in the end of the throttle shaft. When adjustments are required centerpunch and drill out the ball with a 1/4-inch drill bit for access to the restriction plunger. Be careful, when drilling, not to damage bore of throttle shaft. After the required adjustments have been made, insert a new replacement soft steel ball with the Throttle Shaft Ball Installation Tool, part number 3375204.

(3) Adjust the throttle shaft internal fuel adjusting screw for proper pressure. See figure 3-165. If the torque required to turn the fuel adjusting screw is less than 1-1/2 lb-in, a new screw should be installed.



TA 073847

Figure 3-165. Adjusting the Throttle Shaft Internal Fuel Adjusting Screw.

3-124. Calibration Check Points.

a. Check Point I.

(1) Reduce pump speed to 1500 rpm, throttle in full throttle position.

(2) Maintain 50 inches Hg to AFC bellows adjusting tool.

(3) Check that the SELECTOR VALVE is in the ROTAMETER position.

(4) Set fuel flow to 385 pph with the FUEL FLOW CONTROL VALVE.

(5) Read the fuel pressure; it should read 121-127 psi.

(6) If the pressure is above or below range, check the torque spring on the governor plunger; it may not be seated, improperly shimmed, or the wrong spring. If torque spring 138784 is changed, recalibrate the fuel pump. Torque spring shims are available 0.005, 0.010 and 0.020 inch (0.13, 0.25 and 0.51 mm) thick.

b. Check Point 2

(1) Reduce pump speed to 1000 rpm, throttle still in full throttle position.

(2) Maintain 50 inches Hg to AFC bellows adjusting tool.

(3) Check that the SELECTOR VALVE is in the ROTAMETER position.

(4) Set fuel flow to 285 pph with the FUEL FLOW CONTROL VALVE.

(5) Read the fuel pressure; it should read 71-77 psi.

(6) If out of specifications, check the weight-assist plunger protrusion.

CAUTION

The weight-assist plunger must be installed with the smallest end to the governor plunger.

(7) If fuel pressure is low, add shims behind the governor weight-assist plunger in the governor weight carrier. To decrease pressure, remove shims. Shims are available 0.007 and 0.015 inch (0.18 and 0.38 mm) thick. Do not change setting more than 0.020 inch (0.508 mm) from specifications.

3-125. AFC Plunger Setting.

a. Check that the SELECTOR VALVE is at ROTAMETER position, and the throttle lever is in full throttle position.

NOTE

All adjustments at the AFC plunger setting must be made when the no-air adjusting screw is bottomed in the housing.

b. Using a suitable no-air adjustment tool, loosen locknut on no-air adjustment screw in the throttle housing. Turn screw clockwise until it bottoms on seat. See figure 3-166.

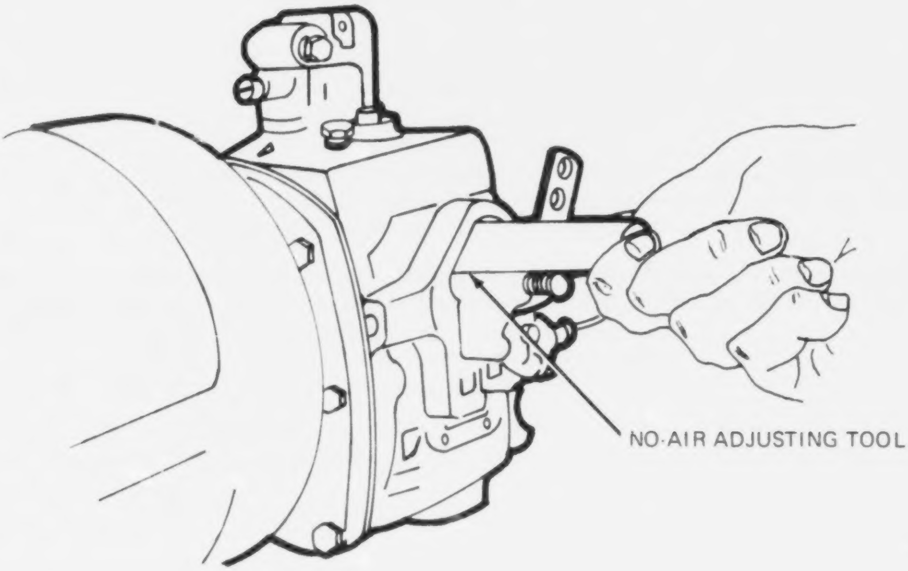


Figure 3-166. No-Air Adjustment Tool

NOTE

Make sure that the AFC plunger threads are sealed with anti-seizing (Teflon) liquid.

c. Set pump speed for 1600 rpm.

CAUTION

If no fuel flows through the pump, it can overheat. Fuel lubricates the pump.

d. Reduce air pressure to 30 inches Hg (0 psi)

e. Let fuel flow go to zero.

CAUTION

Air pressures during AFC plunger setting calibration procedure must always be reached while increasing air pressure on the AFC bellows. If the specified pressure is overshot, reduce pressure to 30 inches Hg (0 psi) and wait until flow stabilizes at or near zero before increasing to correct setting.

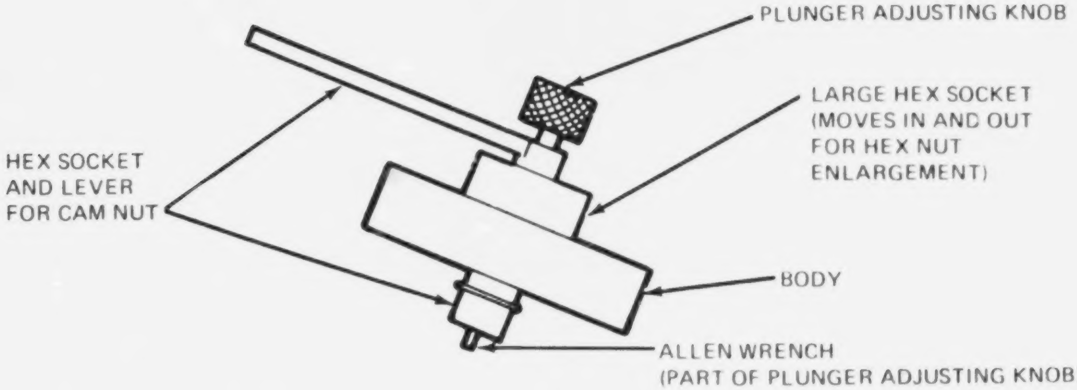
f. Increase air pressure to AFC adjusting tool to 42 inches Hg.

g. Adjust fuel flow rate for 264 pph with FUEL FLOW CONTROL VALVE.

CAUTION

The AFC Adjusting Tool must be used with care. The larqe moveable center hex socket engages the nut that retains the AFC bellows to the plunger. The smaller hex socket loosens the jam nut that locks the AFC plunger. The Allen wrench moves the plunger in and out for proper adjustment.

If the large hex socket is not properly engaged, the AFC bellows can be torn and ripped. The proper sequence is to first engage the large hex socket, then the smaller hext socket, and finally the Allen wrench. See figure 3-167.


PLUNGER ADJUSTING KNOB
LARGE HEX SOCKET (MOVES IN AND OUT FOR HEX NUT ENLARGEMENT)
HEX SOCKET AND LEVER FOR CAM NUT
BODY
ALLEN WRENCH (PART OF PLUNGER ADJUSTING KNOB)

TA 073849

Figure 3-167. AFC Adjusting Tool

h. Using the AFC Adjusting Tool, adjust fuel pressure for 61-67 psi. Adjusting the AFC plunger will require resetting flow rate for 264 pph with FUEL FLOW CONTROL VALVE.

CAUTION

AFC plunger is easily broken when tightening the jamnut. Use extreme care in tightening to 25 to 35 in-lb. Large and small hex sockets of tool 3375137 must be fully retracted after loosening plunger jamnut to avoid interfering with AFC piston travel. If AFC piston position is disturbed while adjusting plunger, repeat adjust sequence.

i. When the AFC control plunger is correct, tighten the plunger locknut to 25-35 lb-in (2.8 - 4.0 N·m) torque. Recheck the pressure and flow to make sure that the limits are correct.

NOTE

To insure that tightening the locknut did not change the setting, check the air set pressure to insure it meets the limits. Increase to 50 in Hg (1270 mm Hg) or 24.5 psi (169 kPa), then decrease the air pressure to 42 inches Hg. If fuel (rail) pressure is more than 81 psi (104 kPa) above the limits, check plunger and barrel for sticking (hysteresis) from contamination, damaged guide ring, or improperly sized barrel or plunger.

j. Reduce the air pressure to zero, stop the test stand, remove the adjusting tool and install the cover plate using plain capscrews at the top and lockwire drilled capscrew in the lower position. Tighten the capscrews to 30-35 lb-in (3.4 - 4.0 N·m) torque.

3-126. No-Air Screw Adjustment.

a. Turn NO-AIR screw counterclockwise 1¼ turns before starting test stand with no air adjustment tool. Run pump at 1600 rpm. Check that SELECTOR VALVE is in ROTAMETER position.

b. Adjust FUEL FLOW CONTROL VALVE for 213 pph.

c. Since the AFC Adjusting Tool has been removed, no air pressure is required. Allow the ASA to vent to atmosphere.

d. Using the No-Air Adjustment Tool, loosen jamnut and adjust the no-air screw until 40 psi fuel pressure at 213 pph is obtained. Reset fuel flow as necessary. After proper adjustment, tighten jamnut.

3-127. Throttle Shaft Cover.

a. Install the throttle shaft cover after all calibration adjustments have been completed. See figure 3-168.

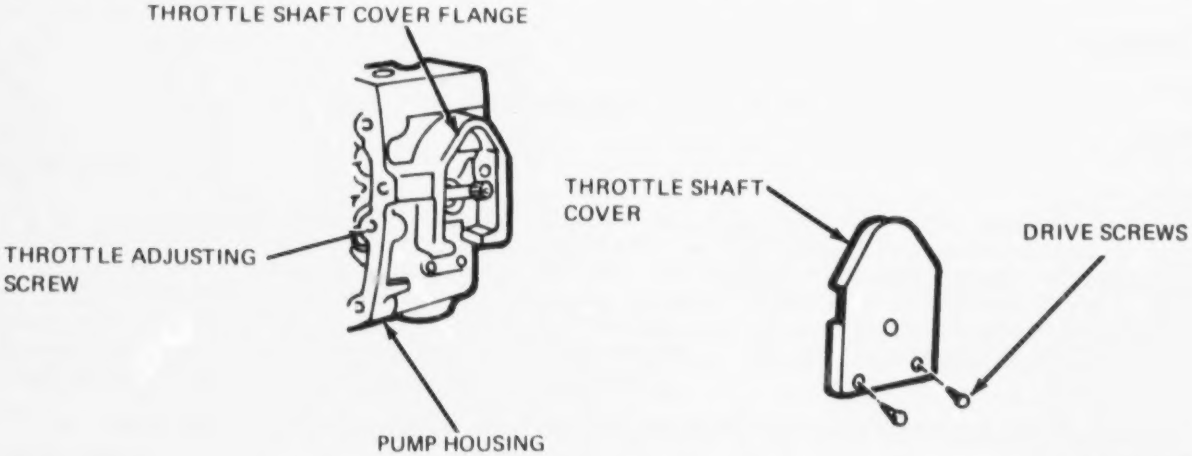


Figure 3-168. Throttle Shaft Cover.

b. Remove the throttle shaft lever.

c. Inspect the original holes in the fuel pump housing for damage.

d. If the holes are damaged beyond use, new holes may be drilled in the throttle shaft cover flange if they are directly opposite one another, and not directly above throttle adjustment screws.

CAUTION

Use care when drilling new holes for the drive screws. The pump housing is made from cast aluminum and is easily damaged.

e. Position the throttle shaft cover on the pump housing.

f. Centerpunch location of new holes on throttle shaft cover if original holes are not going to be used.

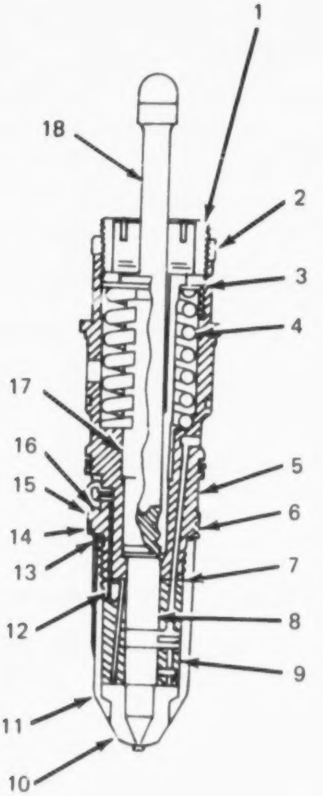
g. Drill through the throttle shaft cover and into the throttle shaft cover flange with a 3/32-inch No. 44 (0.086 in. [2.18 mm]) drill bit for no more than 0.235 in. (5.97 mm).

h. Take two new drive screws and gently tap them into the holes.

i. Install the throttle shaft lever.

Section XXVI. REPAIR OF FUEL INJECTORS

3-128. Top-Stop Injectors. The top-stop injector is a cylindrical injector used in Cummins engines with internal fuel drillings. The top-stop injector cross sectional view is shown in figure 3-169.



1. TOP STOP SCREW
2. LOCKNUT
3. SPRING WASHER
4. SPRING
5. ADAPTOR
6. O-RING
7. SPIRAL PIN
8. PLUNGER
9. BARREL
10. CUP
11. CUP RETAINER
12. CHECK BALL
13. CLIP
14. SCREEN
15. ORIFICE
16. GASKET
17. COUPLING
18. LINK

TA 073851

Figure 3-169. Top-Stop Injector – Cross Section.

3-129. Injector Parts.

a. Adapter. In figure 3-169 the adapter (5) houses the plunger return spring (4), adjustable orifice (15), orifice gasket (16), fuel screen (14) and screen clip (13) and carries the O-ring seals (6) on the outside which seal against the head to form fuel inlet and drain passages. Fuel enters through orifice (15) and flows to barrel (9), passes check ball (12) to the cup-to-barrel passage up to the metering orifice where it is metered into the cup (10). Fuel not used circulates past the metering orifice, around the plunger (8) and out the drain passage while the plunger is seated in the cup. The cup, adapter and barrel are held in assembled position by the cup retainer (11).

b. Metering Orifice. The metering orifice near the cup end of the barrel is of fixed size and must not be altered in any way.

c. *Top-Stop Parts.* The top stop injector parts are the same as the standard PT (type D) except the adapter (5, fig. 3-169) is longer to accommodate the stop. The plunger coupling (17) top is smaller, allowing it to pass through the stop. The injector spring washer (3), adjustable stop screw (1) and stop screw locknut (2) are parts required only for stop injectors.

3-130. Disassembly.

a. Lift out the injector plunger (8), spring washer (3), and spring (4). Remove the spring from the coupling (17) and test as described on the following pages.

b. Store the plunger by standing it on the coupling end.

NOTE

Injector barrels (9) and plungers (8) are not interchangeable.

c. Remove the O-rings (6) from the injector adapter (5) and discard.

d. Remove the button-style screen retainer ring (13) and remove the screen (14) Check the screen and discard if damaged.

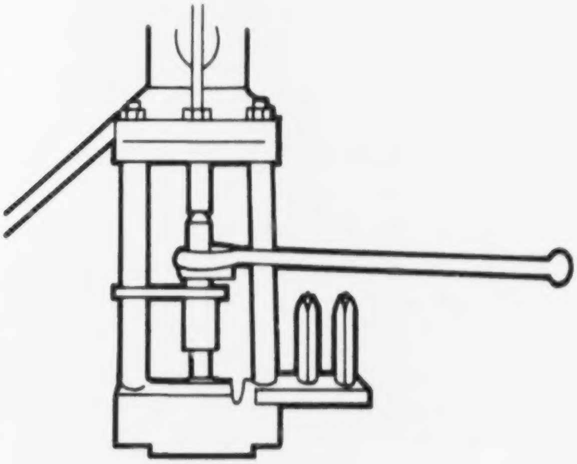
NOTE

Do not remove the adjustable orifice plug from the inlet groove.

e. Insert the injector into the loading fixture.

f. Slide the body wrench over the flats on the injector. Place cup wrench on the injector.

g. Tighten the special screw on loading fixture to hold the injector in place. Loosen the cup retainer (11) but do not remove (fig. 3-170). Use suitable loading fixture for all procedures.



TA 073852

Figure 3-170. Loosening the Cup Retainer.

h. Deactivate the air cylinder or loosen the special screw.

i. Remove the injector clamp and cup wrench from the fixture.

NOTE

Another method of loosening the retainer is to use a 1-1/4 inch box or open end wrench on cup wrench and a 1 inch wrench on injector.

j. Screw off the cup retainer and remove the cup, barrel and discard gasket (if one is present).

CAUTION

Do not lose the check ball.

k. Remove the check ball from the top of the barrel (9), (fig. 3-171).

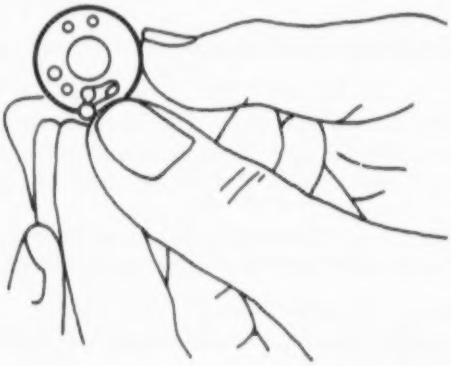

TA 073853

Figure 3-171. Removing the Check Ball.

3-131. Cleaning.

a. Clean the injector parts thoroughly of any carbon varnish by soaking in a solvent such as "Bendix Metal Cleaner," "Kelite Formula 1006" or the equivalent. Ultra-sonic cleaning is recommended for the barrel, plunger and cup.

b. Neutralize the solvent after cleaning by dipping the parts in mineral spirits.

c. Dry with clean compressed air.

CAUTION

Do not use drills or other instruments to clean cup holes that will alter the size of the holes. Wires may be used if a smaller size wire is used than the spray hole. Do not use wire brush or crocus cloth to clean cups that have part number printed on the side.

NOTE

A clean shop; clean tools and good cleaning practices are essential to good injector repair. Most injector failures occur because of dirt. Clean parts before assembly.

3-132. Inspection.

a. Injector Plunger — Coupling.

(1) Check closely for scuffing or scoring. As a rule this is the only true indication of metal seizure.

(2) Bright spots or surface disruption at the top of machined area of plunger on opposite side at the bottom of plunger or at mid-point, usually are normal results of rocker lever thrust action. Unless metal is displaced or wear is measurable at these points, the plunger may be reused.

(3) Narrow streaks running the length of the plunger usually are the result of the varying thickness of penetrant treatment used to prevent rusting. The plunger is satisfactory for reuse unless a surface disruption is evident.

(4) Check the area where plunger is swaged to the coupler for cracks and looseness, by attempting to rotate it by hand.

(5) Excessive wear or fretting may be found on the spring contact area of coupling flange.

(6) Check the socket for wear or cracking.

CAUTION

Handle an injector plunger with care to prevent damage which could render it useless.

b. Injector Spring.

(1) Check the spring for evident wear and mutilation.

(2) Test spring tension on a spring tester (fig. 3-172), that is capable of very accurate measurements of spring lengths and applied load by means of standards and dial indicator gage.

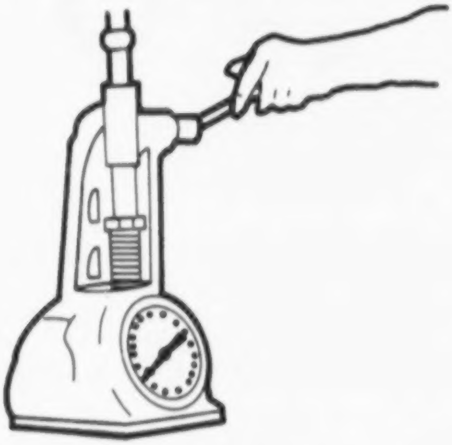

TA 073854

Figure 3-172. Testing an Injector Spring

(3) If injector springs compress to 1.663 inch (42.2 mm), at less than 138 lb (63 kg), springs must be replaced.

c. Injector Cup.

CAUTION

Never alter the size of injector cup spray holes.

(1) Inspect the injector spray holes and tip with a strong magnifying glass. Compare each cup with a new injector cup. Replace the cup if any of the following conditions exist:

(a) Abrasive wear: This wear can begin internally; therefore, inspect both the interior and exterior.

(b) Corrosion damage and the effect of excessive heat. This condition usually results from high acid or sulphur content in fuel or overload operating conditions.

(c) Enlarged or distorted spray holes: Caused by cleaning with drills or other instruments.

(2) Inspect the cup for plunger seat pattern. If the plunger seat covers 40 percent continuous area around the cup cone or plunger bore, it is possible cup may be reused, but it must pass the cup-to-plunger leak test. Seat location is not important (fig. 3-173).

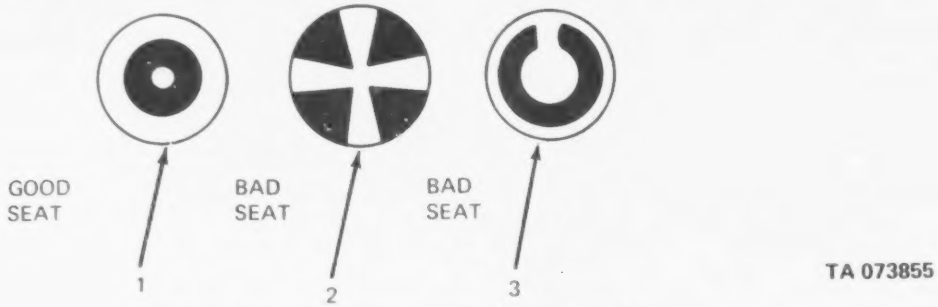


Figure 3-173. Cup Surface at Body Contact Area.

(3) Check the injector cup barrel surface for mutilation and flatness.

(a) For mutilation check in area (black area) as shown in figure 3-174.

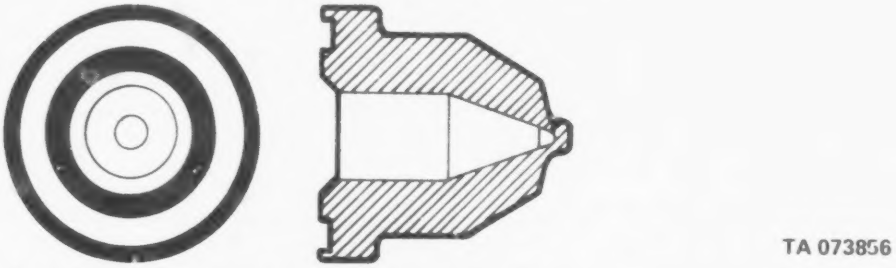


Figure 3-174. Cup Surface at Body Contact Area.

(b) Using a flat steel plate (preferably a lapping plate) and "bluing" to check for surface flatness.

(c) If mutilation or unevenness are found, mark the injector cup for repair.

(4) The injector cups have a black finish.

d. Cup Retainer.

(1) Inspect the threads for damage.

(2) Check the outside cone area for nicks and burrs which could prevent proper seating with the sleeve in the head.

(3) Inspect the inside of the cone area on the cup seating ledge for nicks and burrs which could prevent cup seating.

e. Injector Barrel.

(1) Inspect the injector barrel plunger bore for scoring. If the injector will pass the leakage test, the barrel is useable. If leakage is too high the barrel and plunger must be replaced.

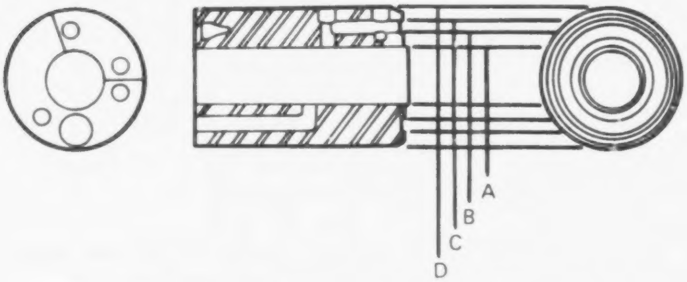
(2) Use a strong magnifying glass to check for burrs, carbon and distorted radii in the orifice. When the metering orifice is damaged, the injector will not function properly. Do not attempt cleaning with wires, plug gages, etc.; use solvent cleaners.

(3) Check the fuel passage plugs for looseness and the barrel for cracks.

(4) Check the injector barrel surfaces for mutilation and flatness in the black area as shown in figure 3-175.

NOTE

The groove has been removed from the cup end of barrels manufactured in England. The measurements are the same.



DIAMETER "A"	0.400 inch (10.16 mm)
DIAMETER "B"	0.540 inch (13.72 mm)
DIAMETER "C"	0.710 inch (18.03 mm)
DIAMETER "D"	0.820 inch (20.83 mm)

TA 073857

Figure 3-175. Barrel Surface at Cup Contact Area.

(a) Thoroughly clean and dry the barrel of all oil fiim before bluing.

(b) Using a surface plate (preferably a lapping plate) and "bluing," check for surface flatness.

(c) If mutilation or unevenness are found, lap to repair.

(d) Do not use crocus cloth or a wire brush on the barrel and cup contact area.

(5) If the injector has been overheated, the barrel to adapter gasket can melt. Loss of the injector cup retainer torque will occur; therefore, the following items should be suspected.

(a) Lubricating oil dilution or blocked injector spray holes.

(b) Damaged injector sleeves or damaged injector plungers.

g. Check Ball and Seat.

(1) Check the ball seat for nicks and burrs.

(a) Do not attempt to improve the checkball seat by inserting a ball and tapping. The barrel is as hard as the ball and will damage the ball if attempted.

(b) If the seat is marred, lap the barrel.

(2) If any wear or mutilation is found, replace the ball. The injector check balls are made of a special material. Do not attempt to substitute with a standard commercially made ball.

h. Adapter.

(1) Check the balance orifice for burrs and other obstructions.

(2) Inspect both fuel passages to be certain they are open.

(3) Inspect the cup retainer threads for damage.

(4) Check O-ring areas for nicks and burrs which could damage the O-rings during installation.

(5) Inspect the barrel mating surface for nicks and burrs. If damage is found, lap to repair.

3-133. Assembly.

a. Drop check ball into top of barrel.

CAUTION

Be certain all mating surface parts are clean and free of burrs or other imperfections which could result in incorrect flow or torque. Lap to repair.

b. Hold the barrel with the check ball up and place new adapter spiral pins into the barrel.

c. Turn the adapter and barrel with the barrel up and place the cup on the barrel.

d. Lubricate the cup retainer threads and cup flange contact area, with engine lube oil and assemble to the adapter. Screw the retainer down finger tight then loosen 1/4 turn.

e. Immerse the injector plunger in clean injector test oil and install it in the adapter without spring.

f. Raise the special stud in the holding fixture.

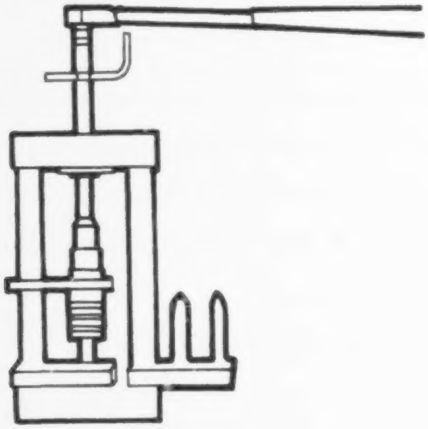
g. Insert the injector into the loading fixture.

h. Slide the body wrench over the flats on the injector adapter.

i. Place the cup wrench on the injector retainer.

j. Lubricate the threads of the stud and screw in the loading fixture stand.

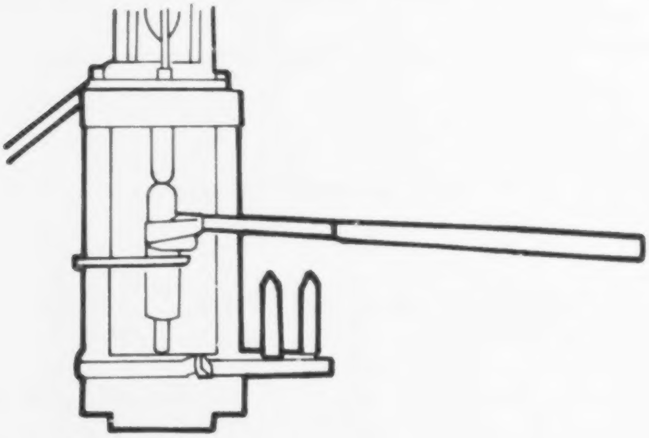
k. Tighten the stud in loading fixture to 75 lb-in (8.5 N·m) (fig. 3-176) to aline the cup and plunger.



TA 073858

Figure 3-176. Torquing the Loading Fixture Stud.

l. Tighten the cup retainer with crowfoot wrench, and cup wrench, to 50 lb-ft (68 N·m) (fig. 3-177).



TA 073859

Figure 3-177. Torquing the Cup Retainer.

m. Remove the injector from the loading fixture being careful not to hit the cup on the stud.

n. To check cup to plunger alinement, remove the plunger and coat it with clean fuel oil or test oil again. Install a suitable plunger extension tool on the plunger.

o. Hold the injector in vertical position (cup down) and allow the plunger to drip a few drops of test oil into the cup.

p. Insert the plunger about 1/2 inch (12.7 mm) into the barrel to be certain the plunger is started straight.

q. Jam the coupling with palm of hand to seat the plunger in the cup and rotate 90° while holding the plunger firmly against the cup seat.

r. Hold injector with the cup up and the plunger should slide out when the injector is lifted quickly.

s. If the plunger does not slide out, remove the plunger, coat the tip and repeat the test.

t. If the plunger sticks because of misalinement, loosen the cup retainer, rotate the cup 1/4 turn, and retorque. Repeat as necessary.

u. Remove the plunger from the adapter and lubricate the plunger with test oil. Install the spring on the plunger and insert into the adapter.

v. Check plunger leakage as described in para 3-134 below.

w. Check the cup spray pattern as described in para 3-134 below.

x. Another method of checking open cup spray holes is as follows:

(1) Remove the plunger and spring.

(2) Fill the barrel and cup full of fuel oil.

WARNING

At any time fuel is forced from cup spray holes be sure to keep hands or body out of the spray stream to prevent injury.

(3) Insert plunger with the plunger extension tool, less spring, into injector forcing fuel out spray holes.

(4) Remove the plunger and install the spring.

y. Lubricate and install new O-rings into the grooves in the adapter.

NOTE

The correct O-rings are identified by a green band.

z. Install a new fuel inlet screen and retainer (fig. 3-178).

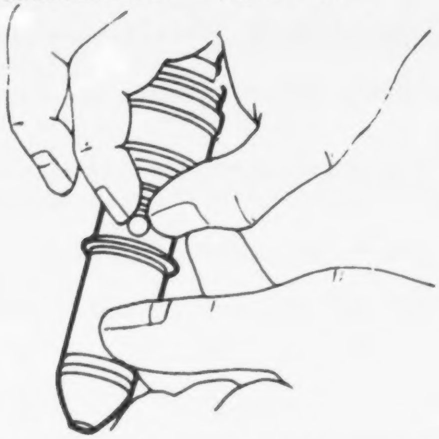


Figure 3-178. Installing the Fuel Inlet Screen and Retainer.

aa. After assembly, store in a clean place until ready for testing and calibration.

3-134. Injector Testing and Calibration.

Operating Instructions of 3375375 Leakage Tester

a. Injector Installation (PT - Flange Type).

(1) Remove strainer and drain fittings from injector and install two 3375459 fittings in their place.

(2) Remove spring and replace plunger.

(3) Install link, 3375373 into plunger and place assembly into injector guide from locking lever end. Align holddown capscrew hole on injector flange with pin on injector guide.

(4) Secure assembly by clamping locking lever (fig. 3-178.1). Install black hose in injector drain port (port nearest operator) and white hose in supply port.

b. Injector Installation (All PT Cylindrical Injectors).

(1) Remove balance orifice clip and screen.

(2) If this is a top stop injector, remove top stop nut, screw, and spring (spring must be removed on all injectors).

(3) Select appropriate adapter pot. The pot for K-Series injectors is stamped "K" or 3375440. Use 3376211 pot for L10 engine and unmarked pot or 3375395 for other series.

NOTE

Damaged O-rings can cause false readings.

(4) Lubricate O-rings with lubricating oil and insert injector into adapter pot.

(5) Install 3375397 adapter, for PT (type D), in top of injector plunger and tighten knurled knob to lock in place.

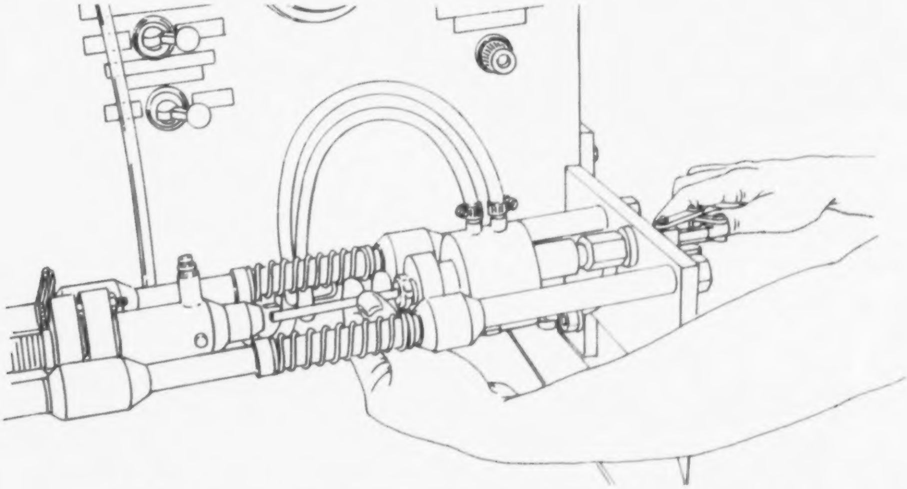
(6) Place 3375401 adapter over injector top with largest diameter against injector flange.

(7) Insert 3375396 link into 3375397 adapter for standard PT (type D) and use 3375398 link for "K" engines without 3375397 adapter. Install assembly, with link end first, into injector guide. Secure in place with locking lever (fig. 3-178.1).

NOTE

White hose is supply and black hose is drain.

(8) Install supply and drain hoses onto fittings on adapter pot. White hose must be toward injector cup.



TA 239216

Figure 3-178.1. (F60244), Installing Injector in Leakage Tester.

c. Cup to Plunger Tip Test.

(1) Adjust air pressure to 60 psi (414 kPa). See steps 3-134 *a.(2)*, *b.(2)* under Installation. These steps are required only on initial set up.

CAUTION

Never "peg" load cell gauge, accuracy will be lost.

(2) Adjust hand crank to show 200 pounds on load cell gauge.

(3) With air supply valve off, turn tip seat plunger leakage valve ON.

NOTE

Air supply valve must be off whenever other valves are switched on or off. If not done, the rush of air may blow oil from bubble checker.

(4) Turn air supply valve ON. Look for bubbles in bubble checker. If no bubbles appear within 10 seconds, or time between bubbles is more than 5 seconds, cup to plunger seating is acceptable, (fig. 3-178.2). If unacceptable, retorque cup.

(5) Turn air supply valve off before removing injector.

NOTE

If test results are acceptable, proceed with "Barrel or Body to Plunger Test".

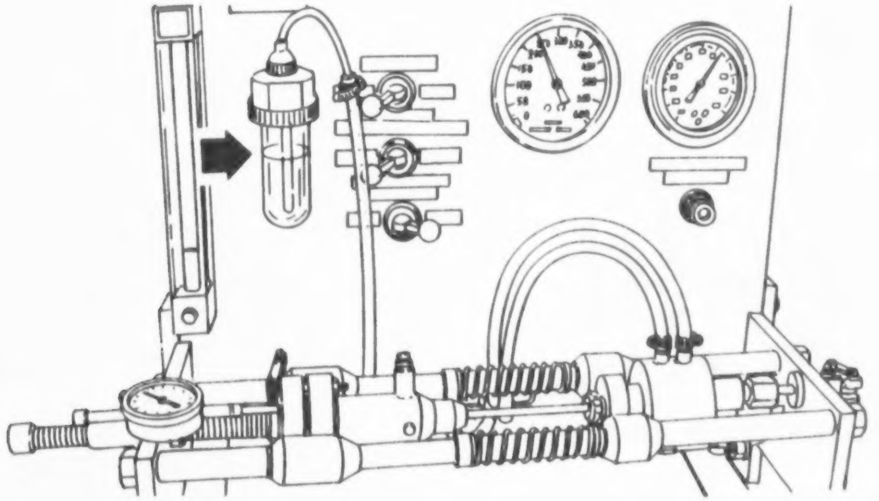

TA 239217

Figure 3-178.2. (F60246), Checking Cup to Plunger Seating.

d. Barrel or Body to Plunger Test.

(1) Adjust air pressure to 60 psi (414 kPa).

CAUTION

Never "peg" load cell gauge, accuracy will be lost.

(2) Adjust hand crank to show 200 pounds on load cell gauge.

(3) Zero dial indicator.

NOTE

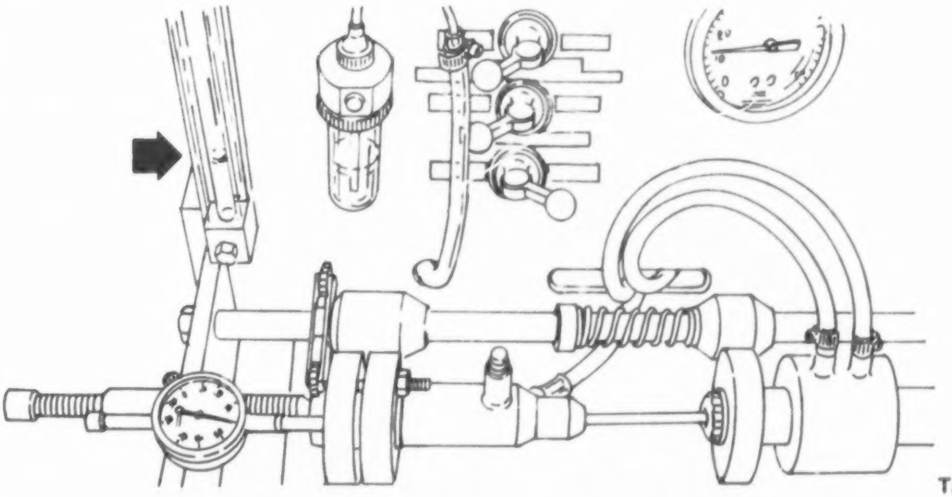
Keep light pressure on load cell plunger toward the indicator while turning crank.

(4) Back out hand crank 0.048 inch (1.22 mm) as measured on dial indicator.

(5) With air supply OFF, turn tip seat plunger leakage valve ON.

(6) Turn air supply valve ON.

(7) Gently rotate injector plunger in small increments, and observe flowmeter for highes reading (fig. 3-178.3).



TA 239218

Figure 3-178.3. (F60247), Measuring Plunger to Body or Barrel Leakage.

NOTE

A zero reading on flowmeter indicates no leakage.

If leakage is within specifications (Table 3-8.1.), proceed with "Check Ball Leakage Test" (Cylindrical injectors only).

If leakage exceeds specifications (Table 3-8.1.), mark injector for plunger replacement.

(8) Turn air supply valve OFF before removing injector.

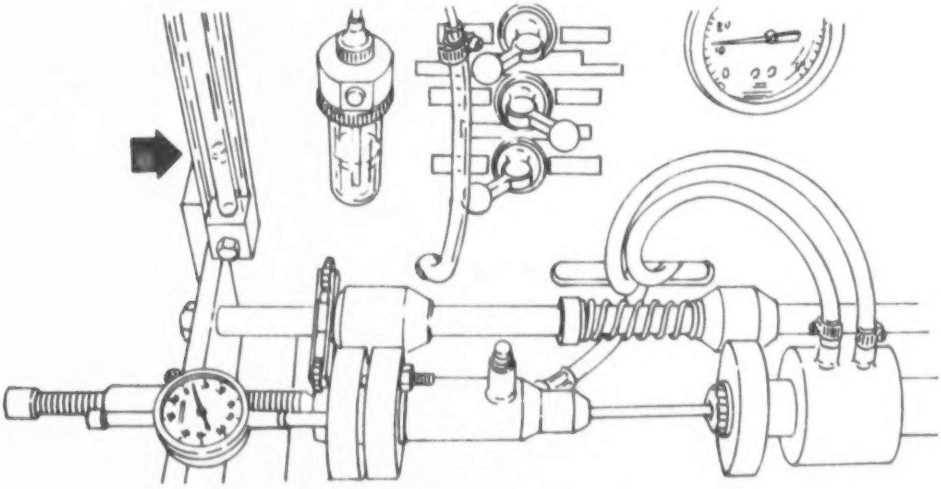
Table 3-8.1. 3375375 Leakage Tester Data	Units	
Injector	New	Used
PT (type D) 3/8 inch Plunger	2.5	4.5
PT (type D) 5/16 inch Plunger	2.2	4.5

e. Check Ball Leakage Test.

(1) With plunger in retracted position, 0.048 inch (1.22 mm) on the indicator, and tip seat plunger leakage valve and air supply valve OFF, turn check ball leakage valve ON.

(2) Turn air supply valve ON and adjust air pressure to 80 psi (550.8 kPa).

(3) Observe flowmeter (fig. 3-178.4). If reading exceeds 12 units of leakage (service limit), rework seat. The ball and seat must be wet with calibration fluid before leakage test can be performed. In some cases, replacing the check ball is all that is required.



TA 239219

Figure 3-178.4. (F60248), Reading Flowmeter for Check Ball Leakage.

NOTE

Before reworking seat area, make sure that check ball and seat have been thoroughly cleaned. A very small particle of debris can give an excessive flowmeter reading.

(4) If a PT (type D) injector ball check is to be reworked, check ball may be seated by slightly lapping ball to seat. A check ball welded to end of a small rod may be used to lap seat. Use 600 grade paste lapping compound.

NOTE

All check ball leakage values are based upon using a fiber ball in the leakage tester flowmeter. Do not use a steel ball in the leakage tester flowmeter.

(5) When check ball is on seat, it must be .025 to .050 inch (.64 to 1.27 mm) below the barrel surface.

NOTE

If the lowest reading on your flowmeter is 1, that is one unit. If your lowest reading is 10, that is one unit.

(6) If the leakage is acceptable, turn air supply and check ball leakage valve OFF before removing injector.

(7) Remove and reassemble injector.

f. Troubleshooting.

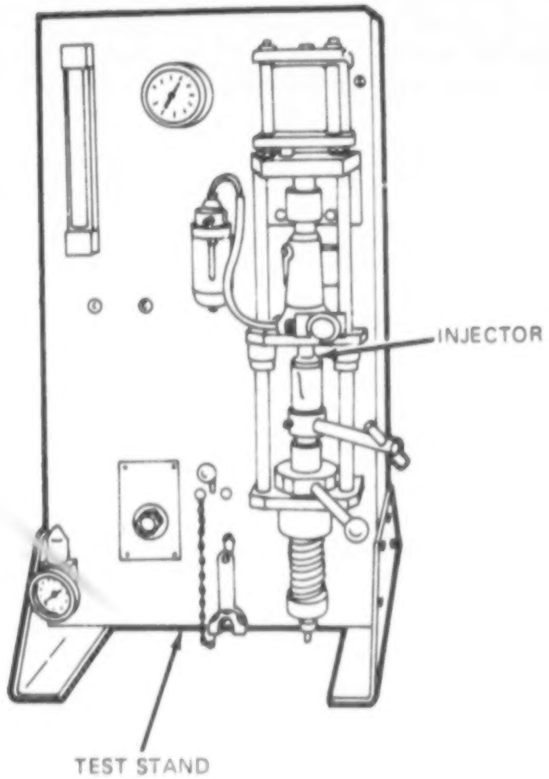
Occasionally, tip seat plunger leakage valve may leak air pressure through bubble checker and flowmeter causing inaccurate assessment of injector quality. A method for checking this failure is to remove white line from injector pot and hold your thumb over the disconnect. If bubbles appear in bubble check or ball in flowmeter rises, valve is leaking. Repair or replace defective parts.

NOTE

Assemble the injector and calibrate as a standard PT (type D) injector, but less the top-stop screw and lock-nut.

a. Testing Injector Plunger Seat.

(1) Using injector adapter pot (part No. 3375086) install an injector assembly on test stand (fig. 3-179).



TA 073861

Figure 3-179. Injector Test Stand.

NOTE

Figure 3-179 illustrates an injector checking fixture currently in use in the Army supply system and is available through normal supply channels.

(2) Attach an 80-90 psi (552-621 kPa) air supply to the test stand air coupling.

(3) Remove the spring and plunger from the assembled injector and re-install the plunger only in the injector body.

(4) Place the injector in test setup with the cup seated in the counterbore below the air valve.

(5) Install the injectors with the drain and outlet holes up.

(6) Position the injector plunger with the size mark centered between the injector inlet and drain openings. Fill the opening with fuel oil and operate the plunger several times to purge any air trapped in the injector.

(7) Seat the handle against the injector plunger link and let the weight control force against the plunger. Do not apply any additional force to the handle during the test.

(8) Turn on the air pressure. The injector is acceptable if the duration of time before the first air bubble appears is more than ten (10) seconds, and the time between observed air bubbles is not less than five (5) seconds.

CAUTION

Before deciding an injector is leaking, be sure that any air trapped in the fuel passage has been purged.

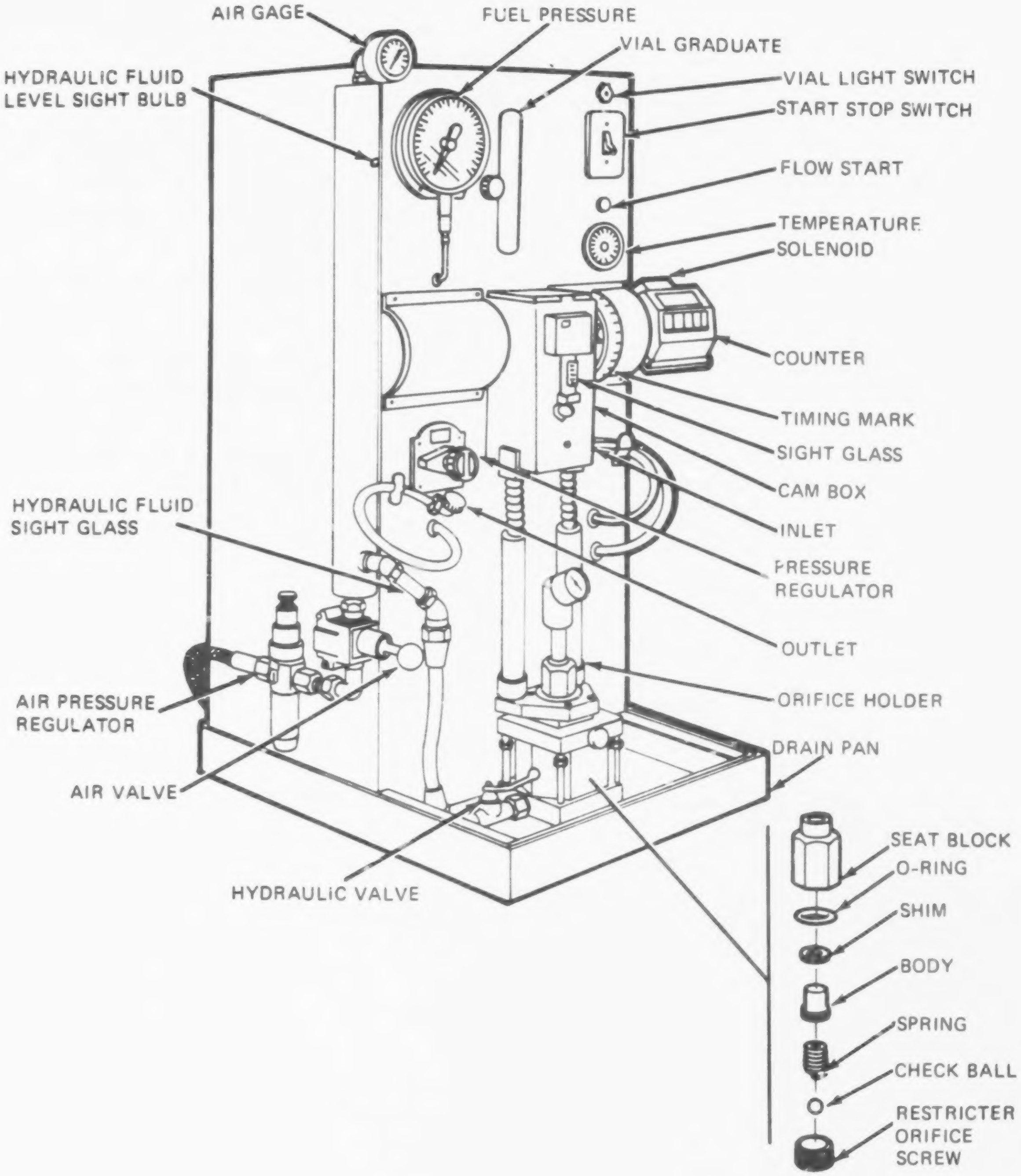
(9) If leakage exists, check for dirt or other foreign material. Changing or reassembly of the cup will often correct the leakage.

(10) If the cup seat is damaged in any way and an injector does not pass the cup-to-plunger seat test, the plunger may be lapped into the cup to obtain good seating. Use no greater than 600 grade paste lapping compound. Applying light pressure, oscillate the plunger in the cup back and forth for approximately one minute.

CAUTION

After lapping, both the cup and plunger must be cleaned thoroughly. Lapping compound will damage the fuel system parts unless removed. The most effective cleaning process is use of an ultrasonic cleaner, if available, and an after-rinse in fuel oil.

(11) If an injector is satisfactory, remove the plunger. Reinstall the spring and plunger.

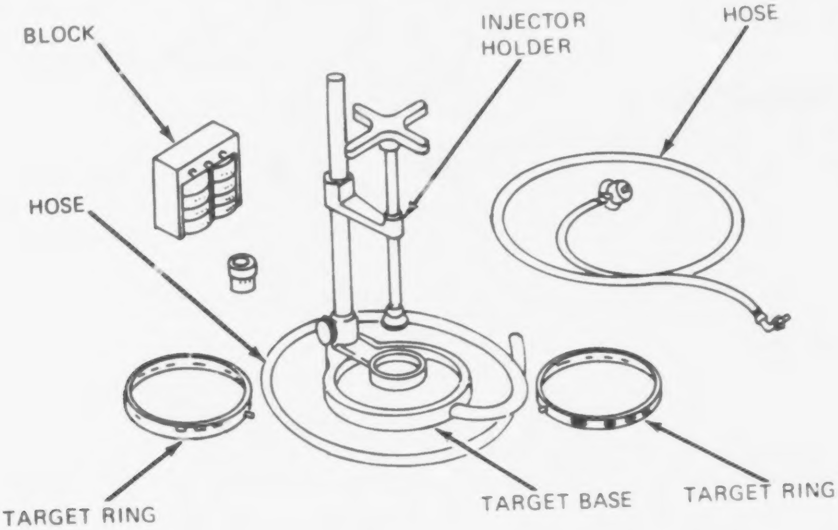

AIR GAGE
FUEL PRESSURE
VIAL GRADUATE
HYDRAULIC FLUID LEVEL SIGHT BULB
VIAL LIGHT SWITCH
START STOP SWITCH
FLOW START
TEMPERATURE
SOLENOID
COUNTER
TIMING MARK
SIGHT GLASS
CAM BOX
INLET
HYDRAULIC FLUID SIGHT GLASS
PRESSURE REGULATOR
OUTLET
ORIFICE HOLDER
AIR PRESSURE REGULATOR
DRAIN PAN
AIR VALVE
SEAT BLOCK
O-RING
HYDRAULIC VALVE
SHIM
BODY
SPRING
CHECK BALL
RESTRICTER ORIFICE SCREW

TA 073862

Figure 3-180. Injector Test Stand.

b. Checking Injector Spray Pattern.

(1) Locate the tester on or near the injection test stand or other source of 22 psi (152 kPa) constant fuel pressure so the injector inlet connection of the test stand will reach the injector to be spray checked. Use injector test oil or diesel fuel to perform the test (fig. 3-181).


BLOCK
INJECTOR HOLDER
HOSE
HOSE
TARGET RING
TARGET BASE
TARGET RING

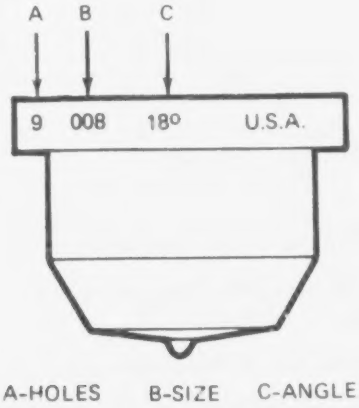
TA 073863

Figure 3-181. Spray Test Fixture.

(2) Attach a drain hose to the tester base and place the loose end on the test stand drain pan.

(3) Assemble a 18° cup seat spacer to the seat bracket bore.

(4) Check cup markings for the number of spray holes (fig. 3-182). Select the appropriate target ring and install in the tester.


A
B
C
9
008
18°
U.S.A.
A-HOLES
B-SIZE
C-ANGLE

TA 073864

Figure 3-182. Markings on Injector Cups.

(5) Insert the injector in the adapter (fig. 3-183).

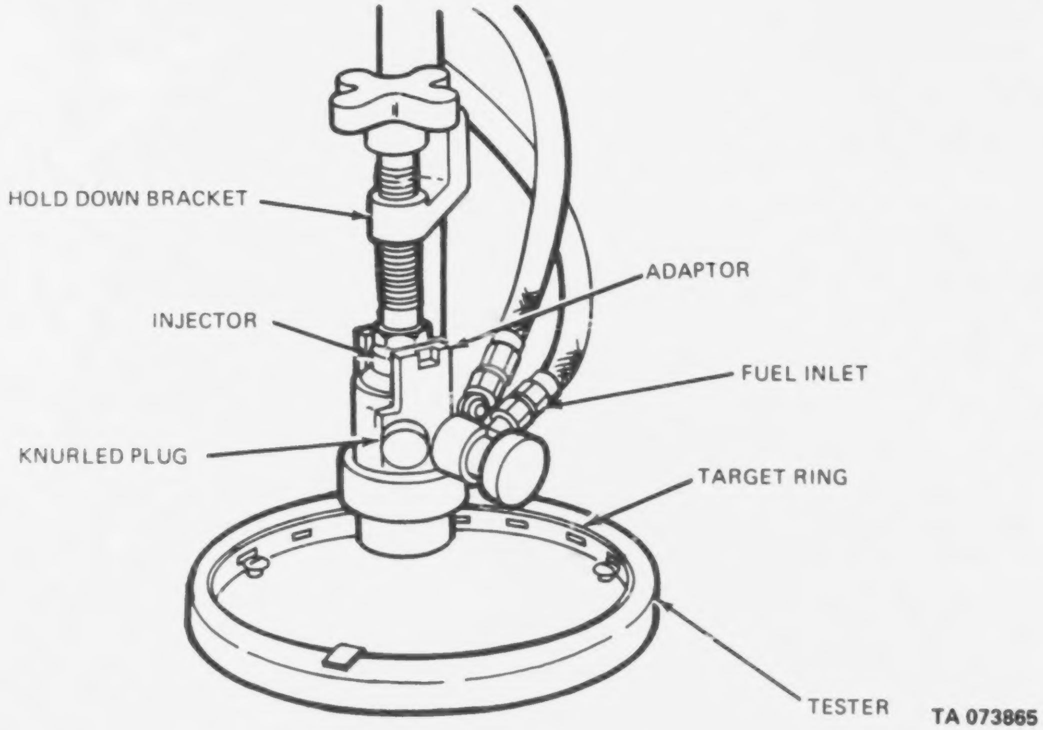


Figure 3-183. Injector Mounted in Adapter.

(6) Remove the plunger assembly and the spring from the injector.

(7) Select the correct size plunger bore plug and rubber seal and install in injector plunger bore.

CAUTION

Protect the injector plunger from dirt or damage during tests.

(8) Install the solid knurled plug, in the injector drain opening adapter.

(9) Place the injector in the spray tester seat and adjust the holddown bracket to the position required, then tighten the thumbscrew.

(10) Tighten the knurled knob against the plug and seal in the plunger bore so it seals thoroughly.

(11) Attach the fuel inlet line from the injector test stand or other pressure source to the injector inlet or adapter.

(12) Start the test stand or other source of fuel and set the pressure at 22 psi (152 kPa).

(13) Shift the target ring in the base of the tool so one spray stream hits the center of No. 1 or index window. This is the tallest window and is next to target slide handle.

(14) Each spray stream must hit a window in the target ring.

(15) After testing, assemble the plunger with the spring in the body and store in clean place until ready for flow test.

c. Checking Injector Flow Using Injector Test Stand.

(1) The injector test stand is used to test all injectors. The injector test stand flow tests the complete injector assembly by measuring fuel delivery. The injector is actuated under controlled conditions closely simulating actual operating conditions. The test stand counts injection strokes, supplying fuel at specified pressure, and measures delivery in a glass graduate. The following preliminary steps and procedures are required prior to test stand operation.

(2) The injector test stand must be located near hot and cold water connections. Water temperature, controlled by a mixing valve, is used to maintain the test fuel at a 90°F-95°F (32°C-35°C) temperature range.

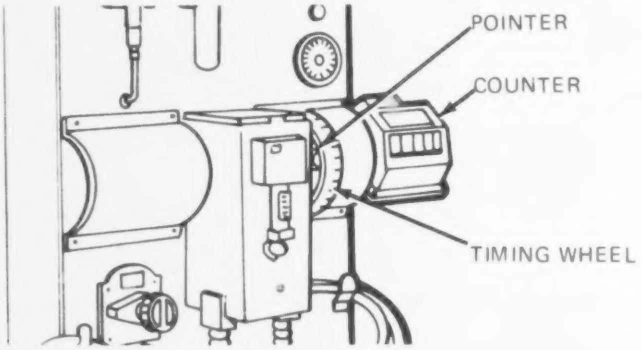
(3) Fill the test fuel tank 3/4 full of test fuel and maintain this level or higher during the test. Test fuel capacity is approximately five gallons.

(4) Fill the hydraulic fluid reservoir to half level in the sight bulb with clean, Type A automatic transmission fluid. Be careful not to allow oil to enter the standpipe in the center of the reservoir.

(5) Fill the cam box with 3 inches of OE/HDO-30 lubricating oil. Refill when the oil level drops to the sight glass.

(6) Plug the electrical connection into a receptacle carrying the necessary voltage to operate the test stand.

(7) Before clamping the injector in the test stand, the cam must be timed by rotating the timing wheel so the wheel mark and pointer are alined (fig. 3-184).



TA 073866

Figure 3-184. Alining the Timing Wheel and Pointer.

(8) Shop air pressure regulated by an air regulator is used to apply a balanced force on the hydraulic system. The air gage at the top of the hydraulic reservoir is used as a reference indicating that the pressure has not changed after being set using a load test cell during test stand calibration (fig. 3-185).

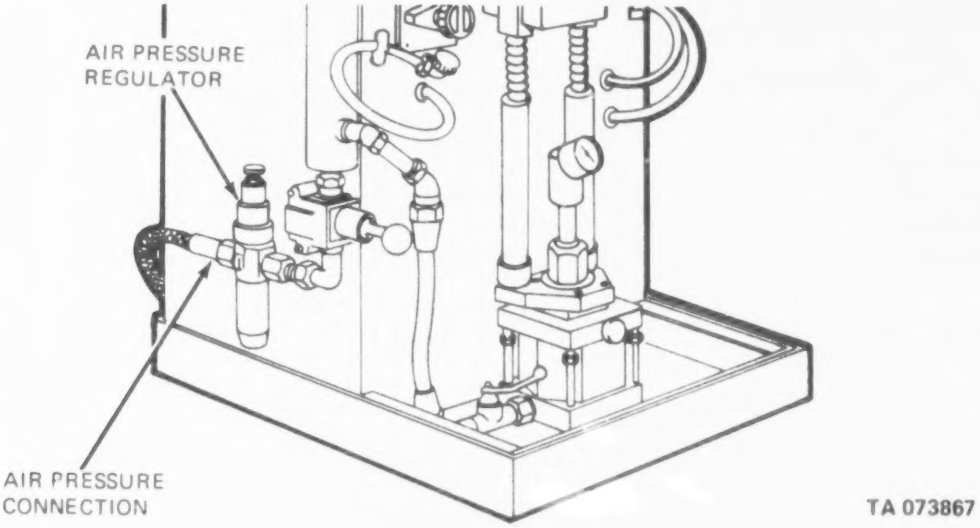
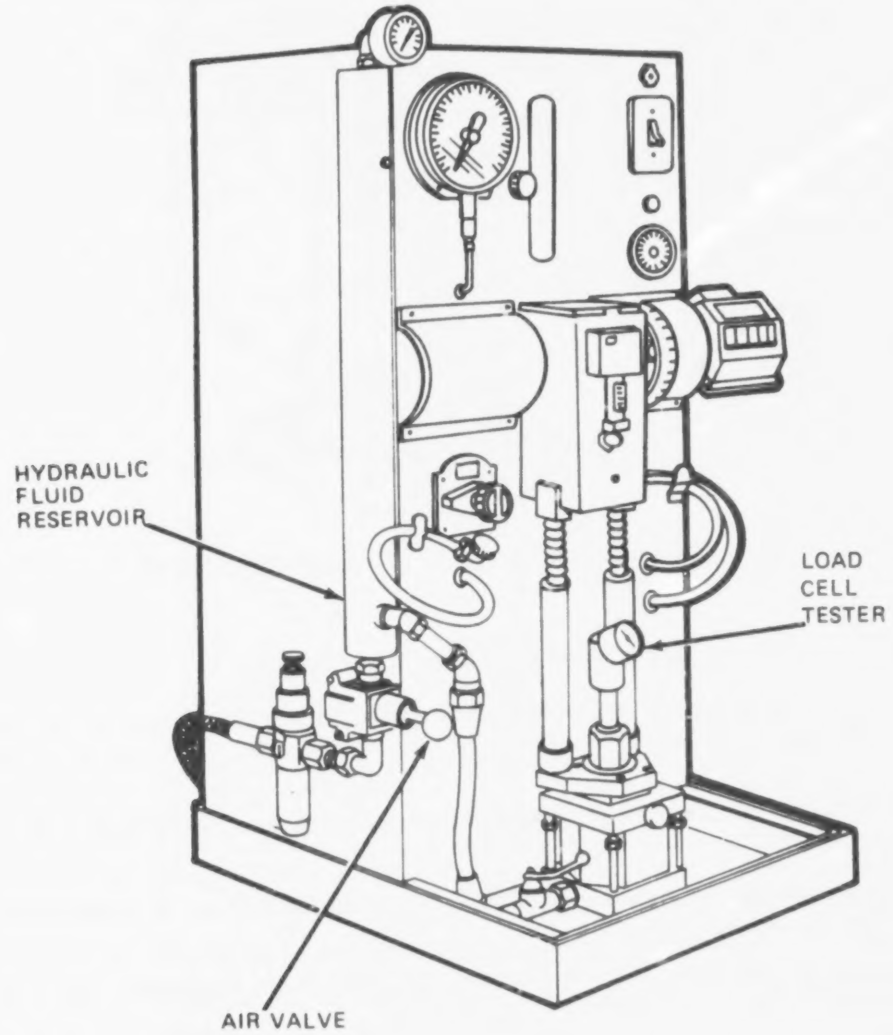

AIR PRESSURE REGULATOR
AIR PRESSURE CONNECTION
TA 073867

Figure 3-185. Air Pressure Connection.

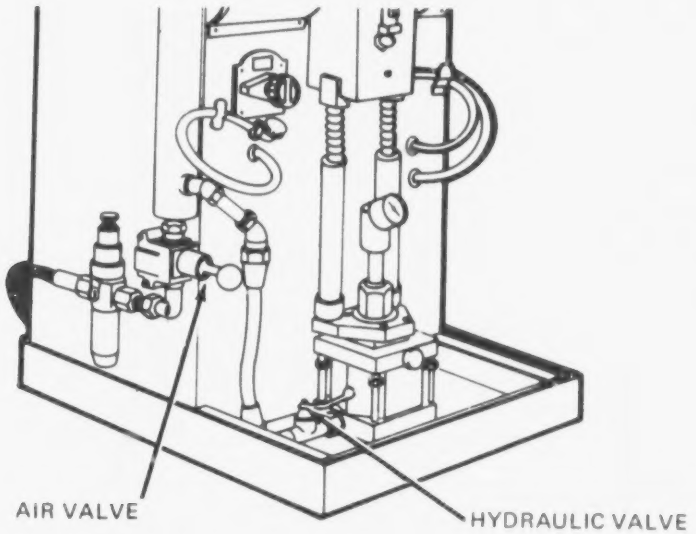
(9) When the air valve is opened, air travels up the pipe in center of the tube type hydraulic fluid reservoir and exerts a downward pressure against column of hydraulic fluid, activating the load cell tester (fig. 3-186).


HYDRAULIC
FLUID
RESERVOIR
LOAD
CELL
TESTER
AIR VALVE

TA 073868

Figure 3-186. Load Cell Tester Installed on Test Stand.

(10) When both the air valve and the hydraulic valve are opened, hydraulic fluid is admitted under the piston in the cylinder and lifts the injector into clamped position. Any leak in the hydraulic clamping system will directly affect injector loading and must not be permitted (fig. 3-187).



TA 073869

Figure 3-187. Hydraulic and Air Valves.

(11) In the clamped position and with the appropriate link in place, tension on the injector is the same as it is in the operating engine. Use of the improper link will affect clamp load and upset delivery values.

(12) Fuel is delivered to the injector through the inlet connector. Fuel pressure here is controlled at this point by a connecting line and pressure regulator (fig. 3-188).

(13) The second connection with a clear plastic line is the injector outlet connection which carries drain fuel from the injector back to the tank.

(14) During test stand operation the operator starts a test cycle which diverts fuel to the vial graduate so the amount of fuel being injected can be measured.

(15) Fuel is delivered to the vial during a measured number of strokes as recorded by the counter.

d. Calibrating Test Stand.

CAUTION

Before operating the test stand make sure that the cam box is filled to the top level of the sight glass with clean OE/HDO-30 oil.

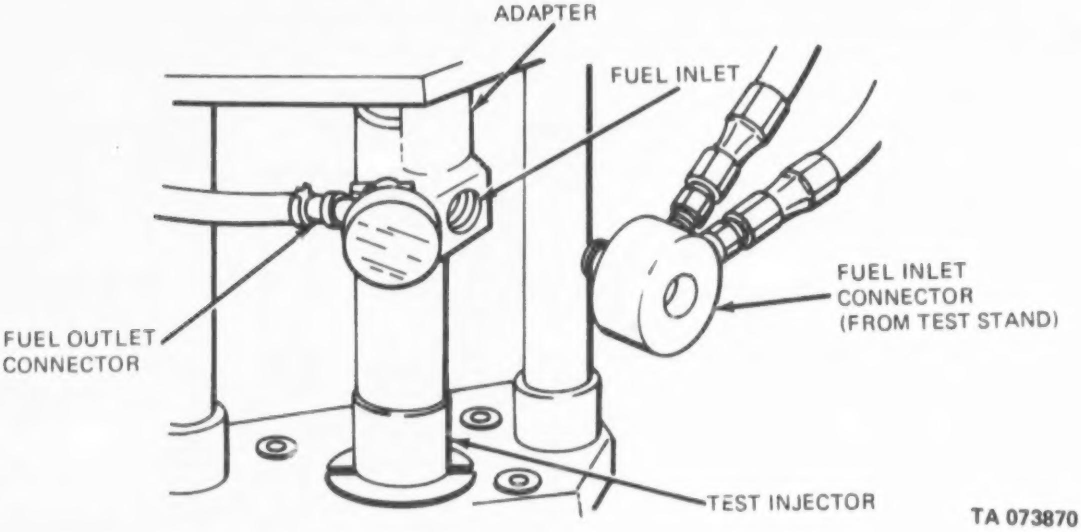

ADAPTER
FUEL INLET
FUEL INLET
CONNECTOR
(FROM TEST STAND)
FUEL OUTLET
CONNECTOR
TEST INJECTOR
TA 073870

Figure 3-188. Installing the Fuel Inlet Connector to the Fuel Injector Adapter.

(1) Install a factory-calibrated master injector gage in the test stand for adjusting the injector for fuel delivery.

CAUTION

The master injector gage must never be tampered with.

(2) Fill the hydraulic fluid reservoir to the bulb level with clean, Type A automatic transmission fluid. Be careful not to allow oil to enter the standpipe in the center of the hydraulic reservoir.

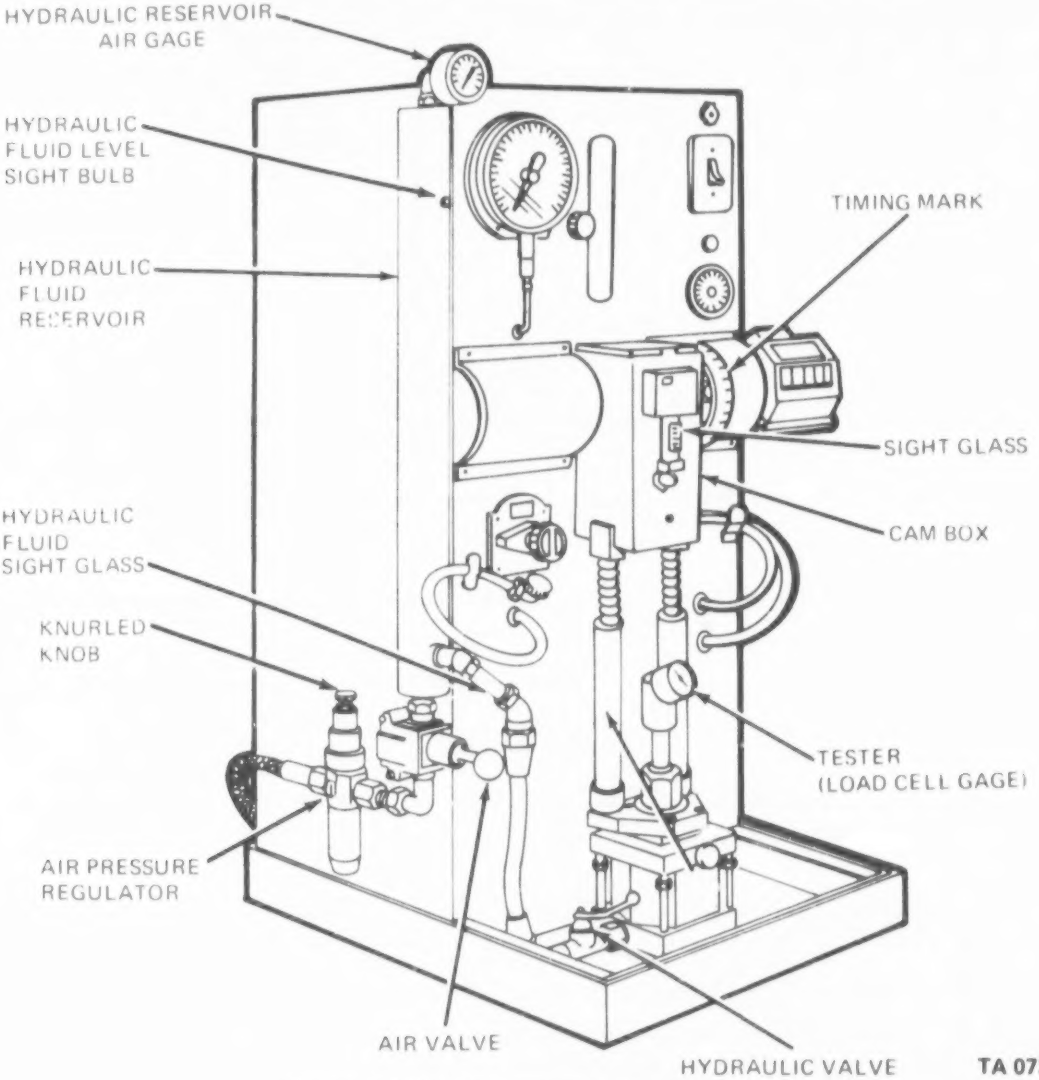
(3) The test oil tank on the test stand must be kept at least 3/4 full of diesel fuel.

(4) Aline the timing mark and close hydraulic valve and open air valve. Place the load cell tester in test stand, and clamp in place by opening the air valve.

CAUTION

Never operate the test stand with the load cell in position.

(5) Adjust the air pressure by turning the knurled button on the air regulator until the load cell indicates within the marked band on the load cell gage. Lock the knurled button in place with the locknut. Note the air gage pressure (gage at the top of the hydraulic reservoir) (fig. 3-189).


HYDRAULIC RESERVOIR AIR GAGE
HYDRAULIC FLUID LEVEL SIGHT BULB
HYDRAULIC FLUID RESERVOIR
TIMING MARK
SIGHT GLASS
CAM BOX
HYDRAULIC FLUID SIGHT GLASS
KNURLED KNOB
TESTER (LOAD CELL GAGE)
AIR PRESSURE REGULATOR
AIR VALVE
HYDRAULIC VALVE

TA 073871

Figure 3-189. Air Pressure Adjustment.

(6) Remove the load cell by returning the air valve knob to the center position. With the cylinder rod in the down position, check to insure hydraulic fluid shows in the hydraulic oil level sight bulb.

(7) Open the air valve. While the cylinder rod is at top of its travel, check to insure there is no air in the hydraulic fluid sight glass.

(8) Insure the injector seat contains a 0.020 inch (0.51 mm) restrictor orifice when calibrating the test stand.

(9) Place the adapter over the master injector gage and engage the locators in the injector mounting holes. Insure the seat is retracted and the timing marks are alined at the timing wheel (fig. 3-190).

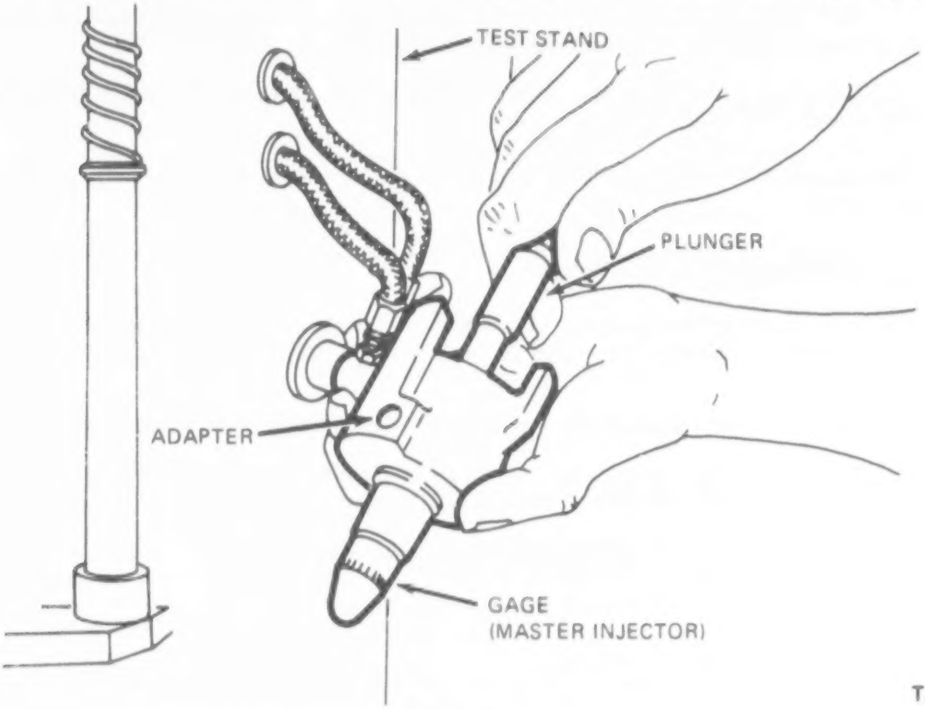


Figure 3-190. Installing Master Injector Gage in Adapter.

(10) Position the test stand link (marked NVH, NG, H) over the injector plunger link and place the assembly in the injector seat, tip back until the link is below the machine push rod. If necessary, adjust the bracket so the link is alined but not rubbing.

(11) Open the air valve and as injector goes in clamped position, insure the plunger link is properly alined and engaged.

(12) Check the air gage pressure at top of the hydraulic reservoir as originally established with the load test cell. Close the hydraulic valve to lock the injector in clamped position. Connect the inlet and drain connectors to the adapter.

(13) Start test stand motor.

NOTE

Test oil must be a minimum of 90°F (32°C). If the temperature is not up to 90°F (32°C), test stand must be warmed up with a standard injector. Do not use a master injector for this purpose.

(14) Adjust the fuel pressure by turning pressure regulator knob until fuel pressure gage shows 120 psi (827 kPa). If this pressure cannot be achieved the trouble is probably due to a sticking air regulator, or to a worn gear pump. Pressure of 120 psi (827 kPa) must be maintained at all times during calibration and testing.

(15) All counter wheels must be set at zero (0) as a starting point.

(a) Shift the silver-colored counter wheels to the right; rotate as necessary to indicate 1020 strokes. Rotate the empty vial into position by turning the vial knob.

(b) Clear the counter by rotating with thumb screw for one complete revolution. All white counter wheels must show zero (0).

(16) Engage the counter and divert fuel to the vial for measurement by pressing and releasing the red flow start switch.

(17) Stir the fuel with a rod to settle out the foam. Check the amount of fuel collected in the vial at the end of 1020 counter strokes.

(18) Look directly into the vial at the fuel level to avoid parallax. If this reading shows 129 cc which is 3 cc below the correct injector master delivery specifications (132 cc @120 psi), or another value, repeat the test.

(19) Dump the fuel from the vial and repeat the test at least twice to insure consistent results.

(20) If 3 cc low, it will be necessary to set counter up to approximately 1043 strokes or about 7 to 8 strokes for each cc. Roll the counter back; all white counter wheels must show zero (0).

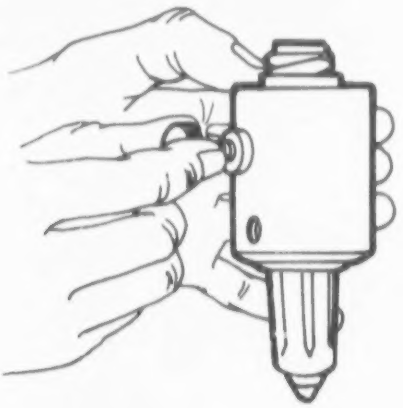
(21) Repeat the tests and adjust counter as necessary to obtain 132 cc delivery at 120 psi (827 kPa) with fuel temperature at 90°F-95°F (32°C-35°C). Check readings for three cycles to insure repeatability. At this point the test stand is correctly calibrated.

e. Testing and Calibrating of Injectors.

(1) Remove the master injector from the test stand after calibrating the test stand. Install the 0.026 inch (0.66 mm) restrictor orifice in cup seat and tighten to 6 lb-in (0.7 N·m).

(2) Lubricate the inside of Service Tool 3375086 body with test oil so injector O-rings will slide into the adapter without damage to O-rings.

(3) Seat the injector in the body so the injector inlet alines with the body inlet hole. Tighten the locating screw (fig. 3-191).



TA 073873

Figure 3-191. Tightening the Locating Screw.

(4) Remove the spring and plunger from the injector adapter. Leave the spring off and install the plunger.

(5) Perform the ball valve seating check before calibrating the injector.

(a) Attach the test stand inlet pressure line to the drain connection of the adapter.

(b) Hold the injector plunger down against its seat in the injector cup with the injector in a vertical position. Assembly may be hand held. Do not place in the test stand holding device.

(c) Turn on test stand, and adjust pressure to 150 psi (1034 kPa).

(d) Check orifice plug inlet opening of the adapter for leakage past ball valve.

NOTE

Insure the plunger is seated in the cup.

(e) If leakage is observed, ball must be replaced.

(6) Install the injector in tool 3375086 body. Disconnect the inlet pressure line from the drain connection of the body. Remove the injector plunger.

(7) Seat the injector so the injector inlet alines with the body inlet hole after the injector adapter is located in the sleeve.

(8) The location screw must seat the hole of the adapter.

(9) Check to be sure the injector inlet is centered in the body inlet hole to prevent breaking ST-708-1 burnishing tool points when installed later.

(10) Install the spring and plunger into the injector.

(11) Assemble the retainer plate over the injector with pins engaging in the body.

(12) Position the injector in the test stand with a suitable adapter link.

NOTE

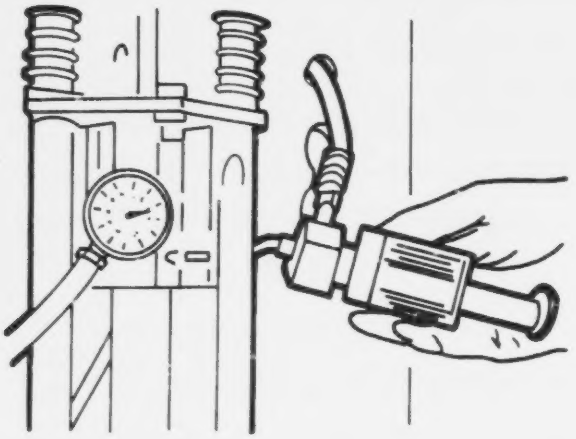
All tests on the test stand are performed without a screen on the injector.

(13) Assemble ST-708 burnishing tool into the test stand injector inlet connector. Retract the needle by pulling out small knob. With the needle retracted ST-708 tool may be left in the connector during all test operations.

NOTE

Injector delivery is adjusted by burnishing the inlet orifice plug with ST-708 instead of changing the plug. The replaceable needle point, ST-708-1, is the burnishing member.

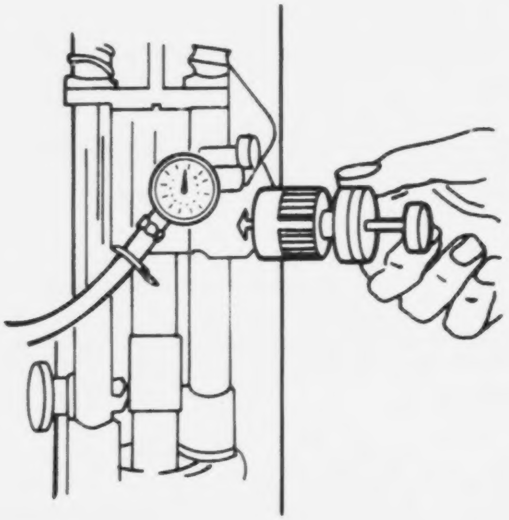
(14) Install the connector and ST-708 tool into tool 3375086 body inlet by screwing in the large knob section (fig. 3-192).



TA 073874

Figure 3-192. Burnishing Tool Installed in the Inlet Connection.

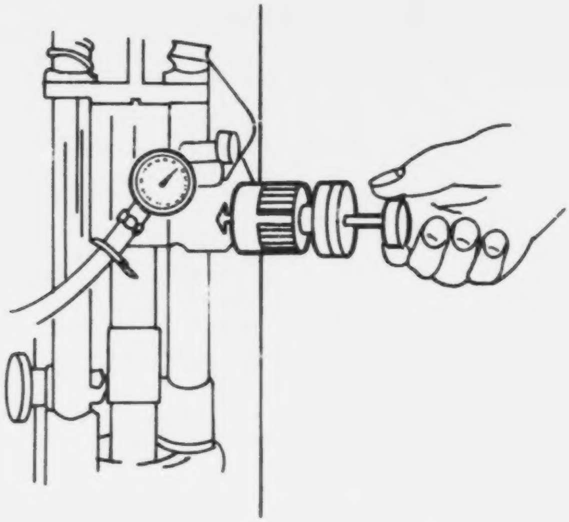
(15) Install the drain connection. Run the injector through a test cycle and check the cc delivery. If 1000 stroke delivery is lower than 175 to 176 cc at 120 psi, turn the knob with indicator point until it is spaced 3/8 inch (9.5 mm) from the large knob (fig. 3-193).



TA 073875

Figure 3-193. Adjusting the Spacing.

(16) Slowly push the small knob in until you feel the needle enter the orifice plug inside diameter (fig. 3-194). Then turn the knob counterclockwise to lock the needle shaft to the larger knob with the indicator. Turn the indicator knob in until you feel the needle contact the plug. Index the indicator with a mark on the largest knob and advance one mark.



TA 073918

Figure 3-194. Burnishing the Orifice.

NOTE

The test stand must be running while burnishing the orifice with ST-708.

(17) Back off the adjusting screw and retract the needle, then check delivery.

(18) If delivery is more than 175 to 176 cc, a new adjustable orifice must be installed in the injector. Tighten the orifice plug to 8-10 lb-in (0.9-1.1 N·m) torque.

NOTE

Orifice plugs have flanges and require a gasket between flange and adapter.

(19) New inlet orifice plugs contain enough stock in the inside diameter so a small displacement of metal by burnishing will increase delivery.

(20) After each four cycles, reclamp the injector to insure maximum accuracy. When delivery is correct, remove the inlet and drain connection.

(21) Remove the injector from the test stand.

(22) Remove the plunger and spring.

(23) Remove the adapter plate and body from the injector adapter.

(24) Install the plunger and spring in the injector adapter.

(25) Insert the disc screen over the orifice and assemble the retainer ring to hold the screen in place.

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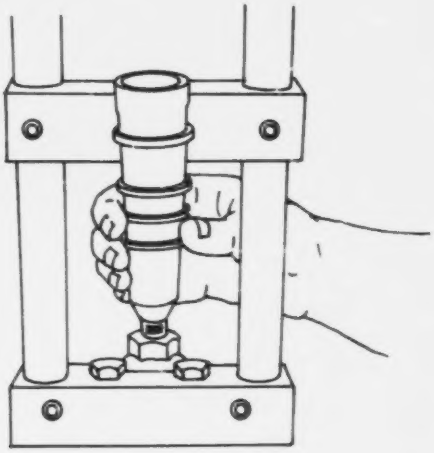
3-135. Top-Stop Injector Adjustment.

a. After calibration install the top-stop screw and locknut into the injector until approximately two of the top threads of the stop protrudes above the locknut; this is a reference point only.

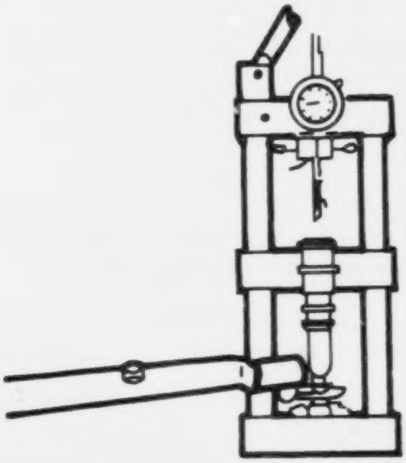
b. Install the injector into the top-stop setting fixture so the injector adapter seats in the fixture and the cup is centered over the cup seat (fig. 3-195).



TA 073876

Figure 3-195. Installing the Injector into the Setting Fixture.

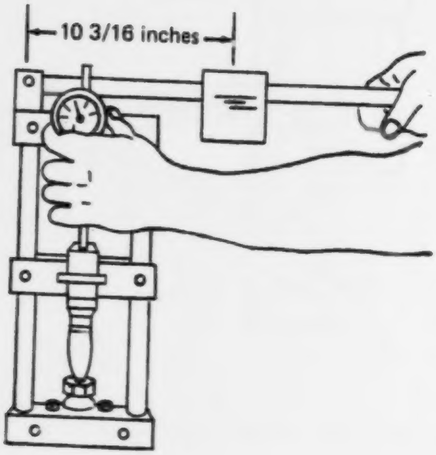
c. Adjust the cup seat upward and tighten the seat to the injector cup with 100-115 lb-in (11-13 N·m) torque (fig. 3-196).



TA 073877

Figure 3-196. Tightening the Injector in the Fixture.

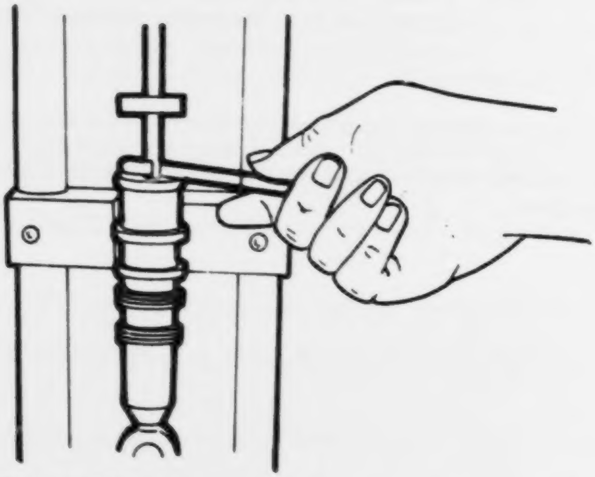
d. The indicator must be in contact with the ring on the plunger coupling. Bottom the injector plunger in the cup with the fixture handle and set the dial indicator at zero with the plunger bottomed (fig. 3-197). Make sure operating lever weight is 10 3/16-inches from the dowel to the weight centerline.



TA 239220

Figure 3-197. Bottom the Plunger and Zero the Dial Indicator.

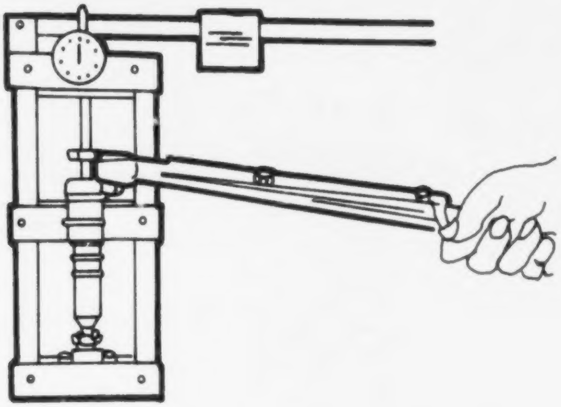
e. Release the plunger slowly and observe the travel required until the plunger spring washer contacts the top-stop. Bottom the plunger again and adjust the stop up or down as required until travel equals 0.222 inch (5.6388 mm) ± 0.0005 inch (0.013 mm), figure 3-198.



TA 073879

Figure 3-198. Adjusting the Stop for Setting Injectors.

f. Tighten the stop locknut to 55 lb-ft (75 N·m) torque (fig. 3-199). Recheck the travel to make sure it was not changed by tightening of the locknut.



TA 073880

Figure 3-199. Torquing the Locknut on Top Stop Injector

3-136. Injector Recheck Specifications. The acceptable variance between the injector test stand is +1 to -2cc from the code stamped on the injector.

For example, an injector stamped flow code 183 would be acceptable if it flows 181-184 cc on stand other than the one employed to calibrate the injector.

3-137. Troubleshooting with Injector Test Stand.

a. Engine performance complaints caused by faulty injector fuel delivery can be determined with the injector test stand. The injector can be removed from the engine and flow tested without disassembly. In this way, injector malfunction can be identified and corrected. Follow normal test procedures as outlined above when calibrating the test stand.

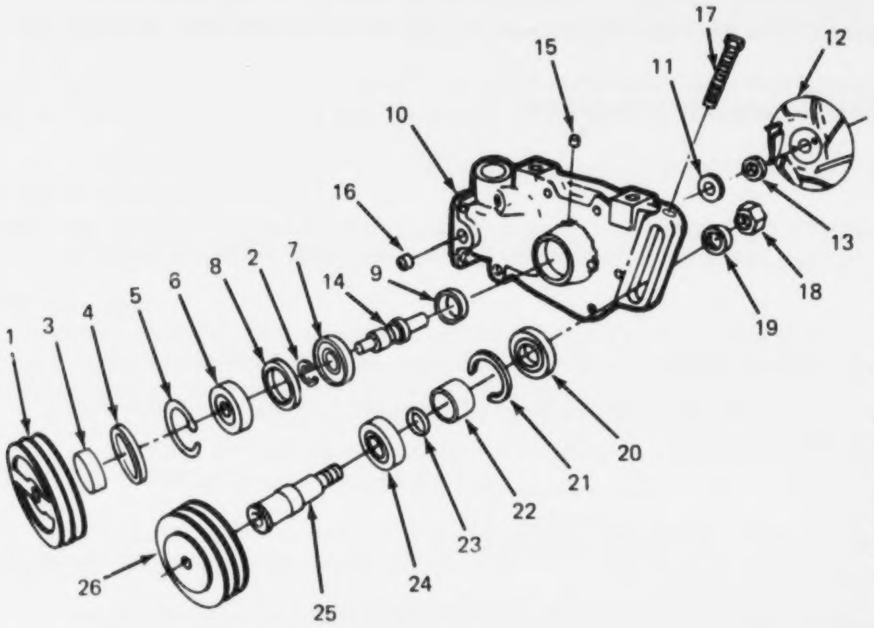
b. Clean the carbon from the injector cup area where it seats in the test stand.

c. Check injector delivery, but do not change the delivery until injector has been disassembled, cleaned, inspected and reassembled.

Section XXVII. REPAIR OF WATER PUMP

3-138. Disassembly and Inspection.

a. Remove the pulley (1, fig. 3-200) and impeller (12) using a suitable puller.



LEGEND:

1.	PULLEY
2.	SNAPRING
3.	SLEEVE
4.	FRONT OIL SEAL
5.	SNAPRING
6.	BEARING, OUTER
7.	BEARING, INNER
8.	BEARING SPACER
9.	REAR OIL SEAL
10.	PUMP HOUSING
11.	SEAL
12.	IMPELLER
13.	SEAL
14.	SHAFT
15.	1/8" PIPE PLUG
16.	PIPE PLUG
17.	FAN ADJUSTING SCREW
18.	NUT
19.	FLAT WASHER
20.	IDLER SHAFT OIL SEAL
21.	SNAPRING
22.	SPACER
23.	O-RING
24.	BALL BEARING
25.	IDLER SHAFT
26.	IDLER PULLEY

TA 073881

Figure 3-200. Water Pump and Idler Pulley – Exploded View.

b. Remove the seal (13), front oil seal (4), and snapring (5).

c. Support the pulley end of the pump housing (10) and press the bearing and shaft assembly from the housing.

d. Using both halves of a bearing puller installed around the bearing spacer (8) in the grease channel, press the shaft (14) through the outer bearing (6) and bearing spacer (8).

e. Remove the snapring (2) securing the inner bearing (7), supporting bearing race. Press the shaft from the bearing.

f. Remove the seal (11) and rear oil seal (9) from the water pump housing (10).

g. If necessary, the 1/8 in. pipe plug (15) and pipe plug (16) may be removed from pump housing (10).

h. Inspect the bearings and spacer for roughness and wear.

i. Inspect the water pump impeller (12) and replace it if cracked or visibly worn.

j. Measure the impeller/pulley bore and shaft diameter. There should be a minimum of 0.001 inch (0.03 mm) press-fit between shaft and bore. Inspect the shaft for straightness and galling on the press-fit diameter surfaces.

k. Inspect the pulley grooves for wear, the water pump for cracks, possible damage from bearing spinning, and that the "weep" hole is open. Repair or replace parts as necessary.

l. Inspect the wear sleeve (3) on the pulley. If grooves are visible, remove the sleeve as follows:

(1) Grind a 15° angle on the end of a 3/16-inch straight shank round punch.

(2) Secure the pulley in a vise. Do not tighten too tight; excessive pressure could crack pulley.

(3) Using the punch, drive the sleeve from the pulley hub by placing the punch through the puller holes in the pulley.

(4) Install a new sleeve with a suitable mandrel.

3-139. Assembly.

a. Lubricate the shaft (14, fig. 3-200) and, using a suitable mandrel seated on the inner race, press the inner bearing (7) over the shaft (14) until it bottoms on the shaft shoulder. Install the snapring (2) and bearing spacer (8).

b. Using a suitable mandrel seated on the inner race of the outer bearing (6), press the bearing on the shaft (14) until it seats against the bearing spacer (8). Check both bearings for free rotation.

c. Install the rear oil seal (9) into the pump housing (10) using suitable seal mandrel with the lip of the seal opposite the impeller end.

CAUTION

Keep the seal face free of grease or other foreign material.

d. Using a suitable mandrel, install a new seal (11), into the pump housing (10) until the seal bottoms in the bore.

e. Press the shaft and bearing assembly into the water pump housing (10) using a mandrel. Do not support the pump housing (10) on thin sections of the impeller cavity. Install the snapring (5).

f. Install the front oil seal (4) into the pump housing (10), using a suitable seal mandrel.

g. Install a new seat (with ceramic facing the seal) on the shaft. Lubricate the bore with permanent anti-freeze to ease installation onto the shaft.

h. Support the water pump on the pulley end of the shaft and press the impeller on the shaft, maintaining 0.020-0.040 inch (0.51-1.02 mm) clearance between the impeller and the cavity.

i. Support the water pump assembly on the impeller end of the shaft (not on the impeller) and press the pulley on the shaft until the pulley hub is flush with the shoulder on the shaft.

j. Remove 1/8 inch pipe plug (15) and install grease fitting. Fill 1/2 to 2/3 full with GAA. Remove grease fitting and replace 1/8 inch pipe plug.

l. If removed, coat threads on 1/8 inch pipe plug (15) and pipe plug (16) with liquid Teflon and install into pump housing (10). Tighten securely.

Section XXVIII. REPAIR OF IDLER PULLEY

3-140. Disassembly and Inspection.

a. Remove the spacer (22) from the shaft (25). Remove the O-ring (23), oil seal (20) and snapring (21).

b. Remove the shaft (25) and bearing (24) assembly from the pulley (26). It may be necessary to remove the pipe plug and use a small punch to knock the shaft and bearing assembly from the pulley.

c. Inspect the idler bearing (24) for roughness and visible wear. Press the shaft (25) from the bearing, inspect the shaft for straightness, galling on the bearing surface and mutilated threads.

d. Inspect the spacer (22) for visible wear or grooves in the oil seal area. If grooves are visible, replace the spacer.

e. Inspect the pulley grooves for wear. Replace parts as necessary.

3-141. Assembly.

a. Lubricate the shaft (25) and using a suitable mandrel seated on the inner race, press the bearing (24) onto the shaft until the inner race bottoms on the flange of the shaft.

b. Supporting the bearing on outer race, press the pulley (26) onto the bearing until the pulley bottoms. Install the snapring (21) in the groove.

c. Using a suitable mandrel, install a new oil seal (20). Lubricate the O-ring (23) and lip of the seal; position the O-ring in the groove of the shaft.

d. Install the idler shaft spacer (22) over the shaft and O-ring. Press into position through the seal until the spacer bottoms against the bearing inner race.

e. Install a new grease fitting and fill 1/2 to 2/3 full with GAA.

f. Position the idler assembly to the water pump housing. Secure it finger tight with a flatwasher (19) and nut (18). Install the adjusting screw (17). Do not tighten.

Section XXIX. REPAIR OF ENGINE RETARDER

3-142. Removal/Disassembly.

NOTE

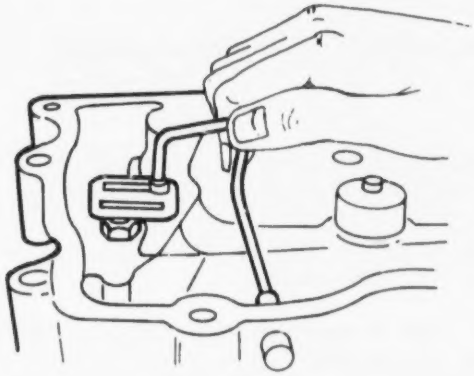
Two models of engine retarder units have been used, 30 and 30E. A housing identification plate indicates the later model 30E which begins with engine retarder serial number A362043. When servicing either model, ALWAYS use the following model 30E components when replacement is necessary. The model 30E slave piston and slave piston retainer MUST be replaced as a set when installed in a model 30 housing.

a. Removal of the Control Valve Assembly.

CAUTION

The cover plate is under load by the control valve stop spring.

(1) Unscrew allen screw and remove the control valve cover plate (fig. 3-201).



TA 083882

Figure 3-201. Removing and Installing the Control Valve Cover Plate.

(2) Remove the control valve stop spring (fig. 3-202).

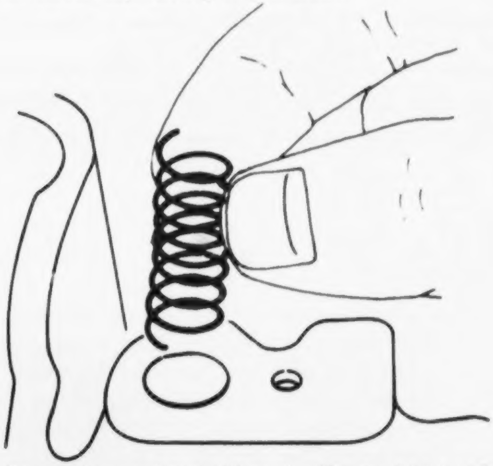


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Figure 3-202. Removing and Installing the Control Valve Stop Spring.

(3) Remove the inner control valve spring (fig. 3-203).

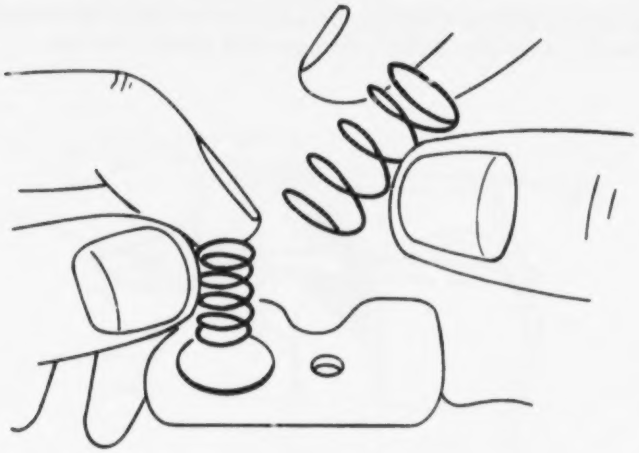
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Figure 3-203. Removing and Installing the Inner Control Spring.

(4) Remove the spool assembly using needle-nose pliers. Pull the valve straight up and out of its bore (fig. 3-204).

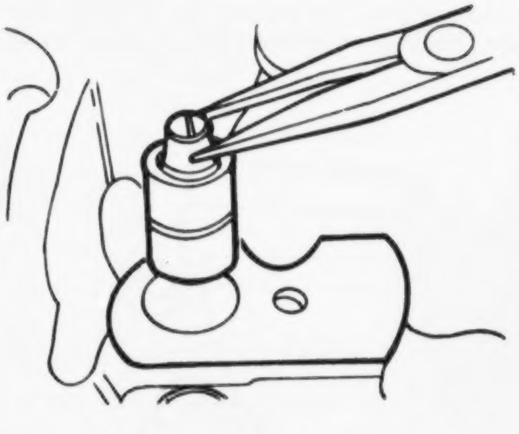
TA 073885

Figure 3-204. Removing and Installing the Spool.

b. *Removal of the Solenoid Unit.* Unscrew harness from solenoid valve assembly using a suitable tool; unscrew the solenoid valve (fig. 3-205). Remove and discard O-rings.

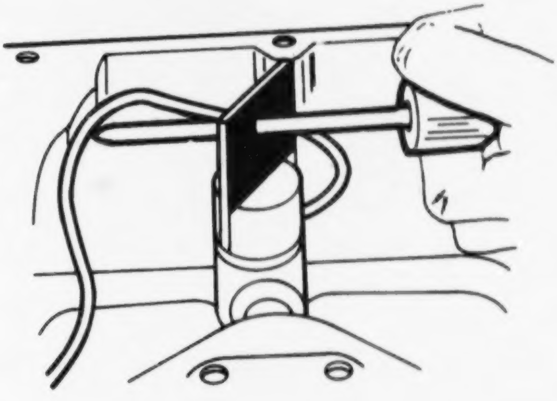
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Figure 3-205. Removing the Solenoid Valve.

c. *Removal of the Master Piston.* On bottom side of engine retarder remove the capscrew and washer (fig. 3-206) and spring holding the master piston in position. Slide out the master piston.

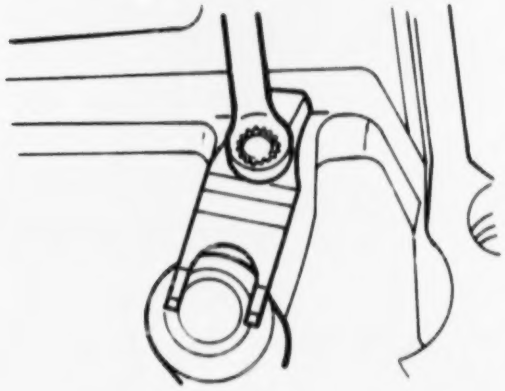
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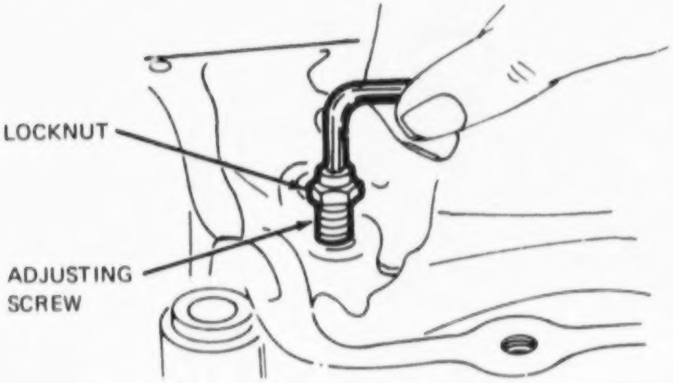
Figure 3-206. Removing and Installing the Master Piston.

d. Removal of the Slave Piston.

(1) Loosen the locknut and remove the slave piston adjusting screw (fig. 3-207).


LOCKNUT
ADJUSTING SCREW

TA 073888

Figure 3-207. Removing and Installing the Slave Piston Adjusting Screw.

(2) Using a "C" clamp and a suitable deep well socket, relieve the tension on the snapring by pushing down on the spring retainer. Remove the snapring, spring retainer, spring and slave piston from the housing (fig. 3-208).

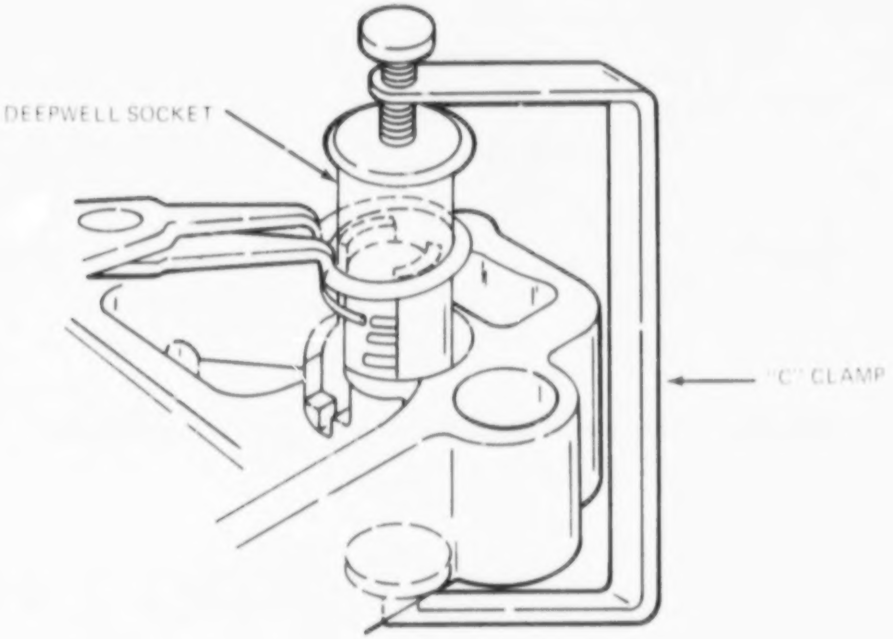


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Figure 3-208. Removing and Installing the Snapring, Retainer, Spring and Slave Piston

3-143. Testing. Test the slave piston spring and the control valve spring on a suitable spring tester. Springs not meeting the values listed in table 3-9 must be replaced.

3-144. Assembly/Installation.

a. Installation of the Slave Piston.

(1) Install the slave piston in the housing (fig. 3-208).

Table 3-9. Spring Data.

Slave Piston Spring	Load at 1.625 in. (41.3mm) 62.5 - 69.5 lbs (278-309 N) Load at 1.478 in. (37.5mm) 71.5 - 80.5 lbs (318-358 N) Free length 2.58 in. (66mm) Number of coils - 13 approx.
Control Valve Spring	Load at .5 in. (12.7mm) 4.7 - 5.3 lbs (21-24 N) Load at .812 in. (20.6mm) .7 - 1.3 lbs (3-6 N) Free length .9 in. (22.9mm) Number of coils - 8 approx

(2) Using a "C" clamp and suitable deepwell socket to depress spring, assemble the components and install the spring, spring retainer, and snapring (fig. 3-208). Insure the spring retainer is in the position shown in figure 3-209.

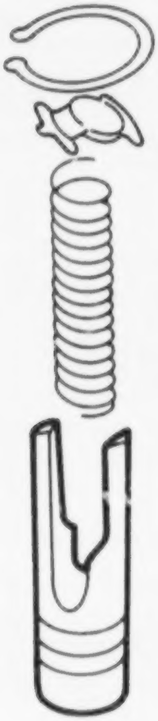

Figure 3-209. Slave Piston Component Positions.

(3) Install the slave piston adjusting screw (fig. 3-207).

b. Installation of the Master Piston.

(1) Install the master piston in the housing.

(2) Assemble the spring to the piston with the concave part of the spring toward the piston (fig. 3-210). The spring must be centered on the turned boss on the top of the piston.

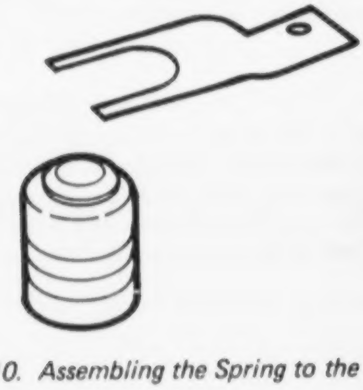

Figure 3-210. Assembling the Spring to the Master Piston.

(3) Install the capscrew and washer and secure the spring and master piston in position in the housing (fig. 3-206).

c. Installation of the Solenoid Valve.

(1) Lubricate the seals with OE/HDO-30 engine oil before assembly.

(2) Install the lower O-ring in the bottom of the solenoid bore housing.

(3) Install the upper and center O-rings on the solenoid valve (fig. 3-211).

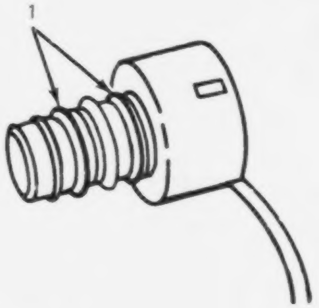

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Figure 3-211. Solenoid Valve O-ring Locations.

(4) Screw the solenoid valve into the housing without disturbing the O-ring positions.

(5) Screw solenoid wire to solenoid valve.

d. Installation of the Control Valve Assembly.

(1) Install the control valve spool in the housing bore (fig. 3-204).

(2) Install the inner control valve spring (fig. 3-203).

(3) Install the control valve stop spring (fig. 3-202).

(4) Install the control valve cover plate and secure in place with an allen screw and lockplate (fig. 3-201).

(5) Lock tabs on lockplate around allen screw.

Section XXX ASSEMBLY OF ENGINE

3-145. General.

a. Engine assembly, as described in this section, is with the assumption that all units have been repaired or are new and are ready to be assembled. During assembly operations, it is important to closely inspect each unit to make sure nothing has been overlooked during inspection and repair. Plugs should be checked for tightness, parts kept clean, openings covered, and machined surfaces protected. Application of any type lubricant should be performed from covered containers.

b. Deviating from certain assembly procedures, as set forth in this section, may be necessary for convenience. If so, simply locate the particular assembly step and follow the instructions given. As an example, some shops may prefer to install the crankshaft before the cylinder liners.

3-146. Mount Cylinder Block to Engine Stand.

a. Secure a suitable block mounting plate to the engine rebuild stand. Secure the water header cover plate adapter and adapter plate to cylinder block.

b. Lift the cylinder block and secure it to the block mounting plate with lockwashers and capscrews.

3-147. Crankshaft and Main Bearings.

a. Turn the cylinder block upside down.

b. Using a clean rag, wipe the main bearing bores and main bearing shells clean. Lay the upper main bearing shells in the block. All upper main bearing shells are grooved and drilled for lubrication. No's. 1, 3 and 5 are alike and No's. 2, 4 and 6 are alike; No. 7 shell has an oil groove off-center. The wide portion of the shell has an oil groove off-center. The wide portion of the shell is installed toward the flywheel end of block. The groove on each shell for the dowel ring must match with the counterbore at the capscrew hole on the exhaust manifold side of the block.

c. Install the main bearing ring dowels. Coat the upper main bearing shells thoroughly with clean lubricating oil.

d. Lift the crankshaft into position, using hooks protected with rubber hose or a rope sling at two crank throws. Roll the upper thrust rings into position with the babbitt or grooved sides next to the crankshaft flanges. The upper thrust rings are not doweled to the block, the lower halves are doweled to the cap.

e. Coat the lower main bearing shells and crankshaft surface with clean lubricating oil. Snap them into place over the crankshaft.

f. Install the lower thrust rings; the rings must be located over the dowels in No. 7 main bearing cap.

g. Inspect the threads in the cylinder block for foreign material and excess oil. Excess oil should be removed to avoid a hydraulic lock failure.

h. Install the main bearing caps with numbers corresponding to those stamped on the camshaft side engine.

i. Lubricate the main bearing capscrew threads with clean engine lubricating oil. Coat under head of capscrew and lockplates with SAE 140W gear lubricant. Install the lockplates and start each capscrew. Tighten alternately and slowly to set the caps into position.

j. Tighten the main bearing capscrews as follows:

(1) Tighten the main bearing capscrews to 140-150 lb-ft (190-203 N·m).

(2) Continue to tighten the capscrews to 300-310 lb-ft (407-420 N·m) to set the shells and caps.

(3) Loosen the capscrews a minimum of 3 turns and retighten to 140-150 lb-ft (190-203 N·m).

(4) Tighten both capscrews on each cap alternately and evenly to 300-310 lb-ft (407-420 N·m) torque.

k. Attach a dial indicator gage securely to the rear of the cylinder block with the contact point of the gage resting on the crankshaft flange end face. With a pry bar, pry crankshaft toward the front of engine. Remove the pry bar and set the gage at 0.

l. Pry the crankshaft toward the rear of the engine. The total gage reading should be 0.007-0.017 inch (0.18-0.43 mm), with a new crankshaft and thrust rings.

m. If the reading is less than 0.007 inch (0.18 mm):

(1) Loosen the bearing cap capscrews slightly.

(2) Shift the crankshaft toward the front and then toward the rear of the engine.

(3) Retighten the capscrews as described above.

(4) Recheck the clearance.

n. If the reading is more than 0.022 inch (0.56 mm), crankshaft must be reworked or oversize thrust rings used.

3-148. Cylinder Liners.

a. Before installing the cylinder liners, check the protrusion as follows:

(1) Place the liner in the block without packing rings in place.

(2) Set two liner holddown blocks (ST 1184) on the block as illustrated in figure 3-212. Torque tools alternately to 50 lb-ft (68 N·m) to seat liner evenly.

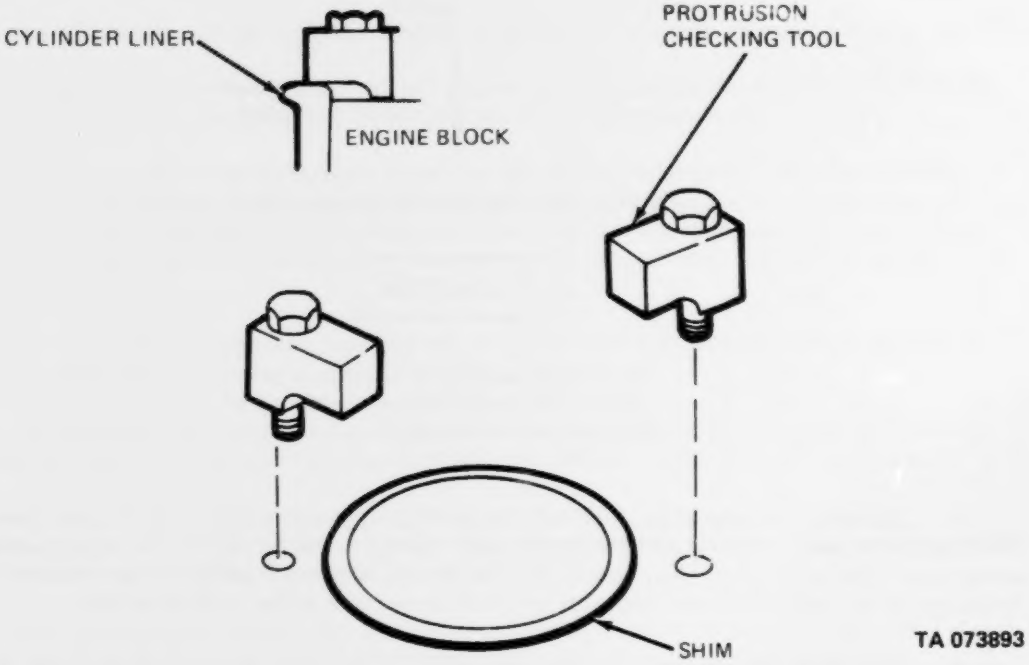

CYLINDER LINER
ENGINE BLOCK
PROTRUSION CHECKING TOOL
SHIM
TA 073893

Figure 3-212. Checking Cylinder Liner Protrusion.

NOTE

Some tools may have been supplied with capscrews not long enough to reach the block thread depth. If so, use the cylinder head bolts with sufficient number of flat washers to mount tool.

(3) Measure the thickness of the cylinder liner lip protruding above the face of the engine block (fig. 3-213). Acceptable limits are 0.003-0.006 inch (0.08-0.15 mm) measured at 4 equidistant points. No more than 0.001 inch variance is allowable at the four points and from one cylinder to the adjacent cylinder. If necessary, install shims around the liner to maintain this protrusion.

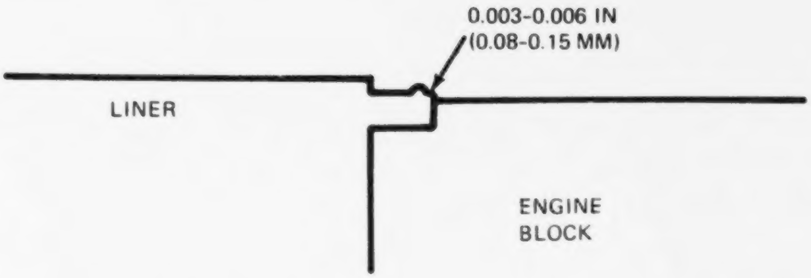


Figure 3-213. Cylinder Liner Protrusion Measurement.

CAUTION

To prevent swelling of O-rings, lubricate lightly with clean engine lubricating oil, just prior to installation.

b. Just prior to installation, lubricate the packing rings with a light coat of clean lubricating oil. Roll them into position and install the crevice seal. Using the mold mark on the ring as a guide, straighten as required. The crevice seal (flat) goes in the top groove. The black packing ring with yellow stripe goes in the center groove and the red ring with two blue stripes goes in the bottom groove.

c. Make sure the liner bore is clean. Lubricate the machined portions of the block on which the rings seat with a light coat of clean engine lubricating oil.

d. Place the liner in the block by hand, being careful to avoid dislodging the O-rings and crevice seal. Press the liner into position. If necessary, use a suitable liner driver to drive the liner securely into the block so it fits squarely into the block bore. Install the cylinder liner holddown tool so the foot of the tool rests upon the wide inner flange on top of the liner. Secure the tool and space the capscrews so even load will be applied. Tighten the capscrews to 50 lb-ft (68 N·m) torque.

e. Use a suitable dial gage block to determine if protrusion meets specifications as prescribed in *a* above.

f. Check the liner bore with a precision dial bore gage, for roundness at several points within the range of piston travel. If the liner is more than 0.002 inch (0.05 mm) out-of-round in the packing ring area, remove the liner and check for the cause of distortion. It is permissible to have 0.003 inch (0.08 mm) out-of-round at the top 1 inch (25.4 mm) of liner bore.

3-149. Connecting Rods and Pistons.

a. Install rings on piston with word "TOP" toward top, using a suitable piston ring expander.

b. Over-expanding a piston ring during installation on the piston can cause distortion resulting in damage leading to failure. The ring should only be expanded enough to allow it to pass over the piston.

c. Stagger the ring gaps so they are not in line with each other or the piston pin. Press the oil ring into the groove at the expansion gap. If the ring face is not flush with the ring land on piston, the expander is out of position. Lubricate the piston, rings, and liner with clean engine lubricating oil.

d. Slide the connecting rod cap from the dowels. Keep the rod cap with its mating connecting rod.

e. Turn the engine to a vertical position on the engine stand and rotate the crankshaft so that the crank throw for the connecting rod and piston being inserted is at the bottom-center position.

f. Compress rings with a ring compressor, insert the piston and rod assembly into the cylinder. Position the numbered side of the rod toward the camshaft side of the block. Push the piston and rod assembly through the ring compressor until the rings are in the liner. Any undue resistance may indicate a problem with the piston rings. Remove the assembly and correct the problem. Use care to prevent scratching of liners.

g. Pull the piston and rod assembly down by the rod, leave assembly short of seating to allow insertion of upper bearing shell.

h. Coat the crankshaft side of the rod bearing shells with clean lubricating oil, and roll the upper bearing shell into the rod. The shell locking tang must fit in the milled recess. Seat the rod on the crank journal.

i. Seat the lower shell in the rod cap and install the rod cap over the dowels so the numbered side of the cap is matched with the numbered side of the rod.

j. Lubricate the capscrew threads with clean lubricating oil. Tighten to torque values. See Table 3-10.

k. The tightened rod should be free to move sideways on crank journal with hand pressure. Side clearance is 0.006-0.011 inch (0.15-0.28 mm). If the rod is not free, remove the cap and check for improper bearing size, burrs, dirt, etc.

Table 3-10. Tightening Connecting Rod Capscrews.

Tightening Sequence	Tightening Values Lb-Ft (N·m)
Step 1 Tighten to	70-75 (95-102)
Step 2 Tighten to	140-150 (190-203)
Step 3 Loosen all	Completely
Step 4 Tighten to	25-30 (34-41)
Step 5 Advance to	70-75 (95-102)
Step 6 Advance to	140-150 (190-203)

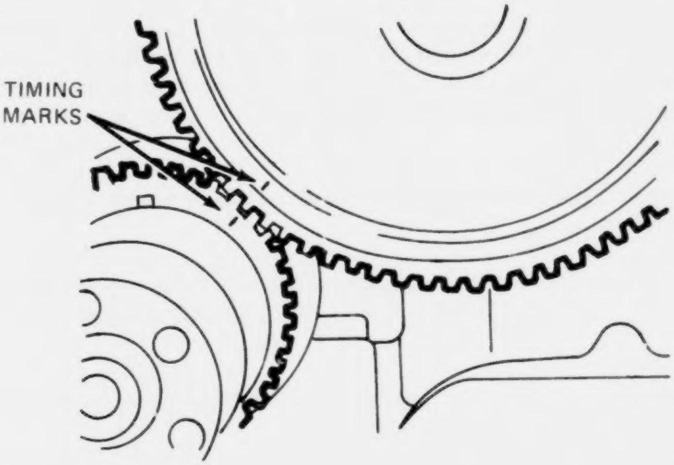
3-150. Camshaft and Gear.

a. Install the cup plug seal in cam bore at rear face, using cup plug driver 3375153. Do not use a socket as this may drive the cup plug too deep and obstruct the oil drain hole in the block.

b. Coat both sides of the thrust ring with high-pressure lubricant and install over the end of the camshaft with the oil grooves toward the camshaft gear.

c. Lubricate the cam lobes with high-pressure lubricant. Install the camshaft, rotating it slowly. Do not damage the lobes or bushings.

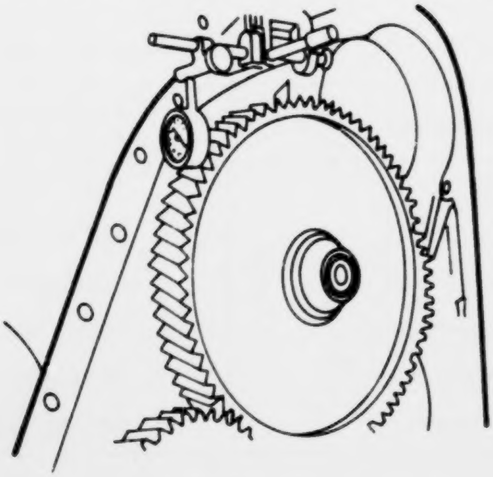
d. Index the timing mark "O" on camshaft gear with the mark "O" on the crankshaft gear (fig. 3-214).



TA 073895

Figure 3-214. Alining the Timing Marks on the Camshaft and the Crankshaft Gear.

e. Attach a dial indicator gage to the block (fig. 3-215); check the camshaft-to-crankshaft gear backlash. Move and zero the gage. Rotate the gear in the opposite direction and read the dial.



TA 073896

Figure 3-215. Checking Gear Backlash.

f. Normal backlash is 0.0045-0.0105 inch (0.114-0.267 mm) on a new gear, with a minimum of 0.002 inch (0.05 mm).

g. The gears will rattle if backlash exceeds 0.010 inch (0.25 mm). If noise is not objectionable, do not replace the gears unless backlash exceeds 0.020 inch (0.51 mm).

3-151. Cylinder Heads.

a. Install a new gasket over the dowels so the word "TOP" on the gasket is visible.

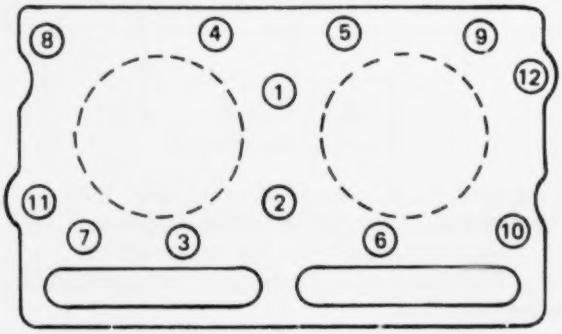
NOTE

All turbocharged engines must use cylinder head capscrews that have letters forged on the head. Do not intermix.

b. Lubricate the entire cylinder head capscrew with rust preservative lubricant. Allow the excess lubricant to drip from the capscrew before installation.

c. Install the washers and capscrews. Torque the capscrews to 25 lb-ft (34 N·m) in the sequence shown in figure 3-216. Continue torquing as shown in figure 3-216 to the final torque of 280-300 lb-ft (380-407 N·m).

3-152. Fuel Crossover. Lube the fuel crossover O-rings with clean engine oil. Install the O-rings in the end of each cylinder head and crossover. Secure the crossover with slotted screws. Tighten with a torque wrench and screwdriver adapter to 34-38 lb-in (3.8 - 4.3 N·m).



STEP	TORQUE (lb-ft)
1	25
2	50-100
3	180-200
4	280-300

TA 073897

Figure 3-216. Cylinder Head Torquing Sequence.

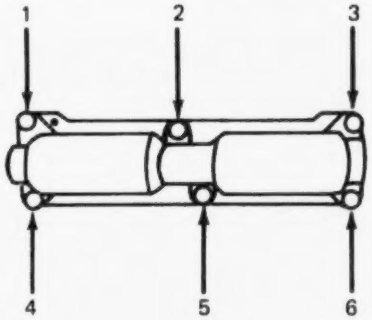
3-153. Cam Followers and Push Tubes.

NOTE

Make sure red sealing material on sealing gasket is not against engine block surface.

a. Install the cam follower gaskets. It may be necessary to add or remove gaskets to obtain the correct injection timing. Use additional gaskets as required to match the thickness of the old gaskets removed during engine disassembly (refer to para 3-6). The total measured thickness includes the sealing gasket. The total gasket thickness (including the sealing gasket) must match the old thickness to the nearest ±0.001 inch.

b. Position the cam follower assembly to the block. Torque the capscrews in sequence as shown in figure 3-217 in increments of 15-20 lb-ft (20-27 N·m) to 30-35 lb-ft (41-47 N·m).



TA 073898

Figure 3-217. Cam Follower Torquing Sequence.

c. Install the push tubes. The injector push tubes are the largest and fit in the middle socket. The intake and exhaust push tubes are identical.

NOTE

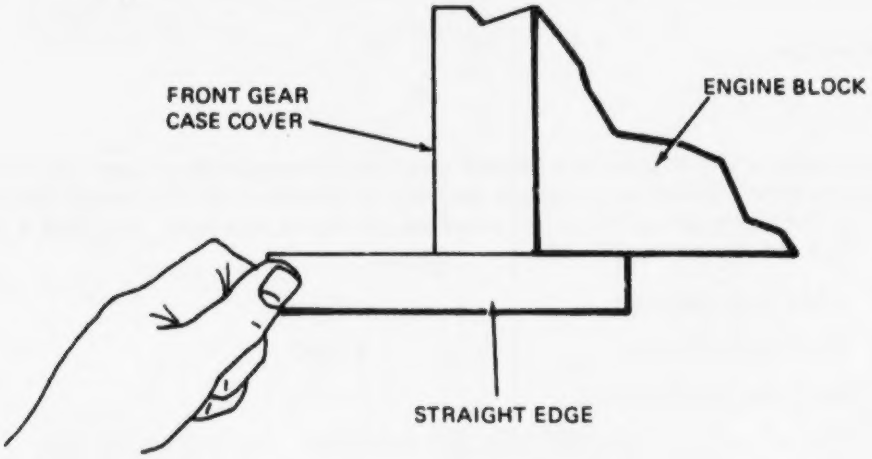
The injector push tube diameter is 3/4 inch (19.05 mm). The valve push tubes are 5/8 inch (15.88 mm) in diameter and 0.070 inch (1.78 mm) longer than the injector push tubes.

3-154. Front Gear Case Cover.

a. Install a new gasket to the gear case cover.

b. Install the gear cover in place over the dowels. Position the front engine support on the front gear cover. Insert and torque all the capscrews to 25-30 lb-ft (34-41 N·m) and then to 45-50 lb-ft (61-68 N·m). Place the two 12-point capscrews in the holes inside the stress ridges in the front engine support. Trim off the excess gasket material at the pan flange mounting area.

c. Make sure that the bottom surface of the cover is within ±0.004 inch (0.10 mm) of flush with the oil pan surface of block (fig. 3-218). If the front cover and oil pan alinement is out of tolerance, remove and check mating surface and gasket of front cover and reinstall.



TA 073899

Figure 3-218. Checking Gear Case Cover to Block Alinement.

d. Install the crankshaft oil seal and compressor drive shaft oil seal.

(1) Check the concentricity of the oil seal bore in relation to the crankshaft. If the total indicator reading exceeds 0.010 inch (0.25 mm) remove, clean and relocate the gear cover.

CAUTION

All surfaces in contact with the crankshaft oil seal must be completely free of oil. Oil on the teflon seal will destroy its sealing properties.

(2) Install Teflon crankshaft seal with ST-1259 seal installer. The front face of the oil seal must be square with the crankshaft axis within 0.010 inch (0.25 mm) total indicator reading.

(3) Install the accessory drive seal in gear case cover with a suitable tool so that the metal face is flush with the cover.

e. Install the camshaft thrust plate or support bearing.

(1) Remove the O-ring seal and spacers. Push the plate or support against the camshaft so the camshaft rests against the thrust washers. Measure the dimension between the thrust plate and gear case cover with a feeler gage.

(2) Using a micrometer, select enough spacers to provide 0.001-0.005 inch (0.03-0.13 mm) camshaft end clearance for engines with camshaft thrust plate, 0.008-0.013 inch (0.20-0.33 mm) for engines with camshaft outboard bearing support.

(3) Install spacers and O-ring seal and secure the thrust plate to gear case cover.

3-155. Timing the Injector.

a. General.

(1) The precise timing of injector push tube travel with corresponding piston travel is accomplished by using a suitable timing fixture to measure the travel of these two parts in thousandths of an inch. The timing code for this engine is BM or BY, reference the engine data plate. Code BM is used for CPL 324 and 327. Code BY is used for CPL 393.

(a) Crank angle (degrees) . . . . 19° btc

(b) Piston travel (inches) 0.2032

(c) Push tube travel (inches)

	BM (CPL 324 and 327)	BY (CPL 393)
1. Nominal	0.053 (1.35 mm)	0.070 (1.78 mm)
2. Fast	0.052 (1.32 mm)	0.069 (1.75 mm)
3. Slow	0.054 (1.37 mm)	0.070 (1.78 mm)

(2) Adjustments to push tube travel are made by altering thickness of cam follower housing gaskets.

(3) The timing operation is performed on one cylinder on each head.

b. Timing Procedures.

(1) Position the timing fixture in injector sleeve. Engage the rod of the push tube indicator in the injector push tube socket. Secure the fixture in place by tightening the knurled holddowns evenly by hand. Be sure the fixture is straight in the cylinder (fig. 3-219).

NOTE

Each of the two dial indicators used on the timing engine must have total travel of at least 0.250 inch (6.35 mm).

(2) Loosen both indicator supports to prevent damage. Turn the engine crankshaft to bring the piston to top of center of compression stroke. Position the piston indicator to compress the indicator stem to within 0.010 inch (0.254 mm) of the inner travel stop (fig. 3-220). Zero the indicator dial at this point.

(3) Position the push tube indicator on the push rod follower to about 0.020 inch (0.5 mm) from its inner travel stop. Zero the indicator dial at this point.

(4) Turn the crankshaft opposite direction of rotation (3, fig. 3-220) to position piston follower rod at 45° BTC.

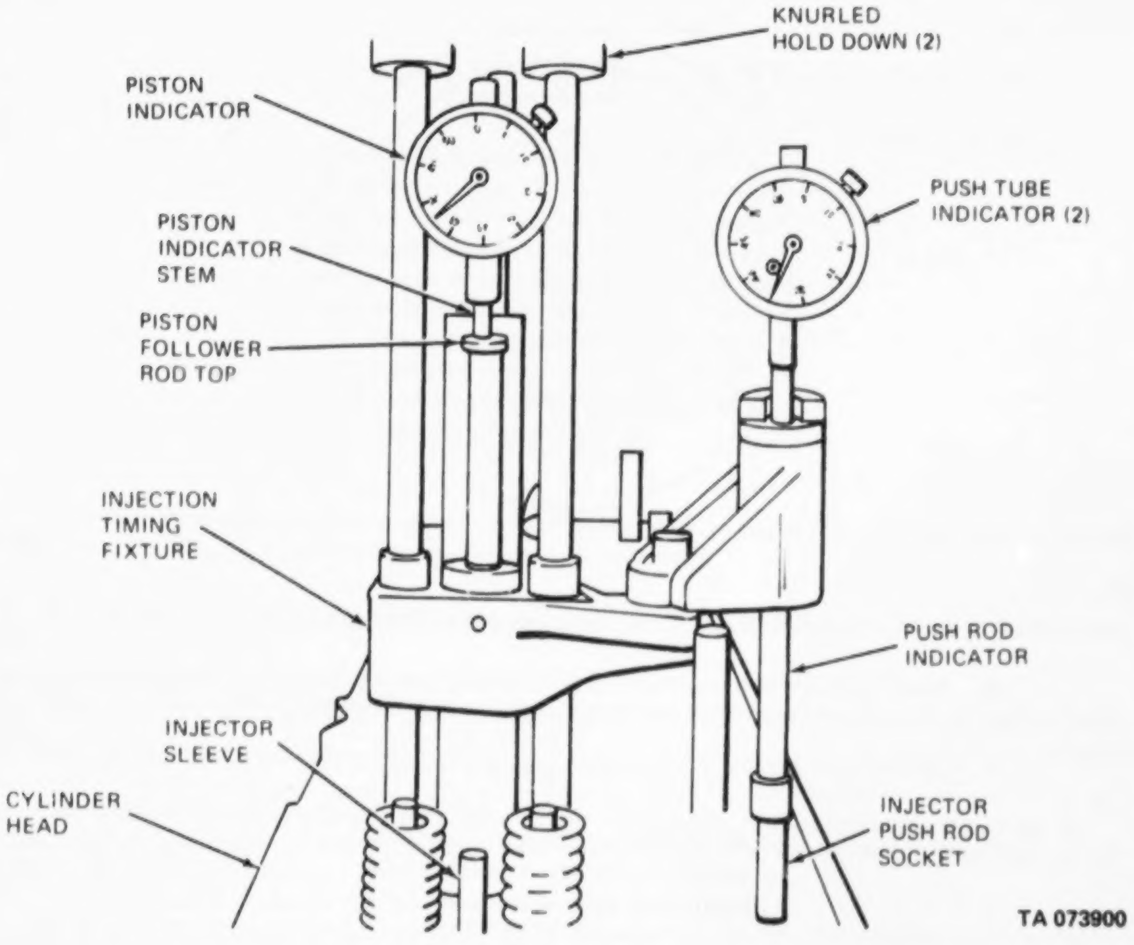
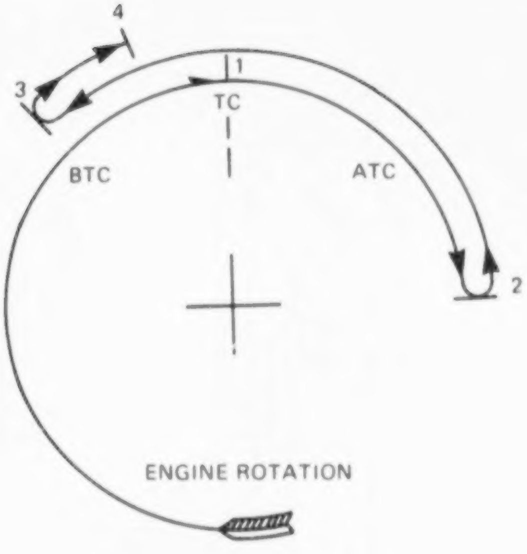

KNURLED HOLD DOWN (2)
PISTON INDICATOR
PISTON INDICATOR STEM
PISTON FOLLOWER ROD TOP
PUSH TUBE INDICATOR (2)
INJECTION TIMING FIXTURE
PUSH ROD INDICATOR
INJECTOR SLEEVE
CYLINDER HEAD
INJECTOR PUSH ROD SOCKET
TA 073900

Figure 3-219. Installing the Injection Timing Fixture.

NOTE

Both indicators move in the same direction when the cylinder is on the proper stroke. If the push tube indicator does not move in the same direction as the piston indicator, turn the crankshaft one complete revolution to place the cylinder on the compression stroke.

(5) Turn the crankshaft in the direction of rotation until the piston follower rod is almost in contact with the indicator stem. Gently move the crankshaft to position the piston indicator to 0.0032 inch (0.081 mm) before 0. This position is actually 0.2032 inch (5.16 mm) before 0 since the indicator will have reached (hand will have gone around twice) over 0.200 inch (5.08 mm) as the crankshaft was moved to 45° BTC. This position (4, fig. 3-220) is 19° BTC. Since exact reading in ten-thousandths must be estimated, exercise care in bringing piston travel indicator to reading.



TA 073901

Figure 3-220. Injection Timing Procedure Schematic.

(6) Read the push tube travel indicator. It should read the number of thousandths before zero that is called for in *a (1)*, above. Notice that range of about 0.004 inch (0.10 mm) is within specifications.

NOTE

Never make a change in cam follower gaskets for timing purposes before making the following checks.

(a) Be sure the cam follower housing capscrews are torqued to 30-35 lb-ft (41-47 N·m).

(b) Recheck the indicator positioning. Be sure the indicators are not bottoming or binding.

(c) Carefully recheck the top-center position. Be sure each step is carried out as described.

(7) If the push tube travel is greater than the limits indicated in *(1)* above, engine timing is slow. If the push tube travel is less, timing is fast. Injection timing may be advanced or retarded by adding or removing cam follower gaskets. Remove gaskets to retard timing.

(8) For practical purposes, the engine is timed at the first piston indicator setting of 0.2032 inch (5.16 mm) BTC.

(9) Remove the timing fixture from engine.

3-156. Injectors.

CAUTION

Do not use screwdriver or too large a rag or wooden dowel. If a screwdriver is used, the cup seat may be grooved or damaged causing compression leakage past the injector cup. If the rag is too large, part of it may be shredded off and remain in the drilled fuel passages in the cylinder head. If the wooden dowel is too large, it will either splinter, leaving bits of wood in the fuel passages, or it will not fit.

a. Clean injector sleeve in cylinder heads. Use 0.75-inch wooden dowel rod with a slot cut in the end to hold a clean rag. The rag should be approximately 5 inches square.

b. Replace the three O-rings on injector body. Place O-rings marked with green bands in bottom two grooves.

c. Lubricate O-rings with clean engine oil.

d. Start the injector into bore, guide by hand until centered in bore and not binding.

e. Place a clean blunt object (a socket is ideal) on the injector body (link removed and plunger installed) and seat the injector with a sharp rap of a soft-nose mallet. A snap should be heard and felt as the cup seats in the sleeve.

CAUTION

If the injector is not completely seated, remove the injector and check for a twisted O-ring.

f. Place the holddown plate over injector body with part numbers up. Start the holddown capscrews. Do not tighten.

g. Carefully insert the injector plunger link.

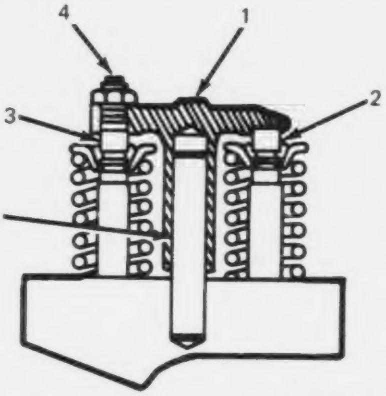
h. Alternately torque the holddown capscrews to 132-144 lb-in (14-16 N·m) in 48 lb-in (5 N·m) increments.

i. Raise the injector link 1/3 of its length and allow it to fall back. If the plunger binds or sticks, loosen the capscrews and retorque.

3-157. Fuel Fittings. Coat fuel fittings with sealer. Inlet and drain fittings are installed in the rear of No. 3 head.

3-158. Crosshead Adjustment.

a. Loosen valve crosshead adjusting screw locknut and back off adjusting screw (fig. 3-221) one turn.



1. CROSSHEAD
2. VALVE STEM
3. VALVE STEM
4. ADJUSTING SCREW
5. CROSSHEAD GUIDE

TA 073902

Figure 3-221. Valve Crosshead – Sectional View.

b. Use light finger pressure at rocker lever contact surface (1) to hold in contact with valve stem (2). Turn down adjusting screw until it touches valve stem (3).

c. Advance setscrew an additional 20°-30° to straighten stem on its guide. Using ST-669 Torque Wrench Adapter, tighten locknuts to 22-26 lb-ft (30-35 N·m). If ST-669 is not available, hold screws with screwdriver and tighten locknuts to 25-30 lb-ft (34-41 N·m).

d. Check clearance between crosshead and valve spring retainer with wire gage. There must be a minimum of 0.025 inch (0.64 mm) clearance.

3-159. Rocker Lever Housing.

a. Position the new rocker lever housing gaskets on the cylinder head.

b. Loosen the locknuts and back off rocker lever adjusting screws two or three turns. Holding the rocker levers in place, assemble the housing in place with the ball ends of the rocker levers fitting into their respective push tube sockets.

c. Secure the housing with studs and washers as shown in Figure 3-222. Torque studs in sequence (fig. 3-222) to 20-25 lb-ft (27-34 N·m), then to 40-45 lb-ft (52-54 N·m) and finally to 60-65 lb-ft (81-82 N·m).

3-160. Compressor Drive. Bar the engine over by inserting two capscrews in the end of the crankshaft and sliding a long bar between them. Stop when the No. 1 cylinder is at the TDC position (firing stroke); continue rotating to 90° ATC. In this position, the two center-punched marks on the drive gear will mesh or index with the two dash marks on the camshaft gear. Later this timing is required so external timing marks on accessory drive pulley will be properly alined with the timing mark on the front gear case cover

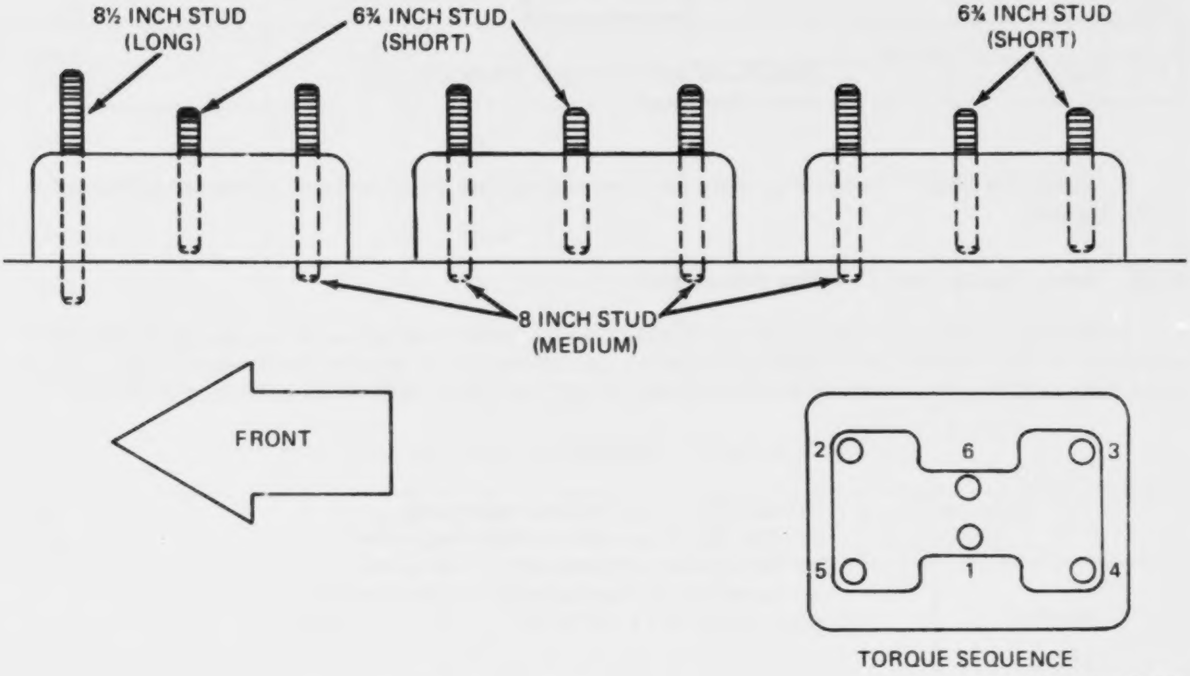


Figure 3-222. Securing Rocker Lever Housing

to show the valve and injector adjustment position. Prior to insertion, aline the keyway of the drive shaft in the air compressor support at the top. Insert the air compressor support, maintaining key alinement, and secure it to the cylinder block. Tighten capscrews to 40–50 lb-ft (55–62 N·m) torque.

3-161. Air Compressor and Fuel Pump. For balance of the engine and air compressor reciprocating force, the coupling driven air compressor must be timed to the engine firing order.

a. Rotate the air compressor crankshaft so the piston is at TDC.

b. Position and secure the fuel pump to the air compressor with a new gasket and drive coupling in place, using the same part number as removed. Tighten the fuel pump mounting screws until they are snug. Be sure engine mounting bracket is connected.

c. Assemble the splined coupling to the air compressor drive shaft.

d. With a new gasket in place, position the fuel pump and air compressor coupling to the accessory drive shaft; secure the air compressor to the air compressor front support. Special wrench M.1321 (3375159) is required to tighten the air compressor mounting capscrew closest to the engine block.

3-162. Spin-On Type Fuel Filter.

a. Fill the new spin-on filter with clean fuel.

CAUTION

Mechanical tightening will distort or crack filter head.

b. Install the filter. Tighten it by hand until the seal touches the filter head; tighten an additional 1/2 to 3/4 turn.

3-163. Valve, Injector, and Top Stop Adjustment.

a. Bar engine until "A" (fig. 3-223 and 3-224) mark on pulley is alined with the pointer on the gear case cover. In this position, both valve rocker levers for cylinder No. 5 must be free (valves closed). Injector plunger for cylinder No. 3 must be at top of travel; if not, bar engine 360°; realine marks with pointer.

NOTE

Cylinder No. 3 for injector setting and cylinder No. 5 for valve setting are selected for illustration purposes only. Any cylinder combination may be used as a starting point (tables 3-11 and 3-13).

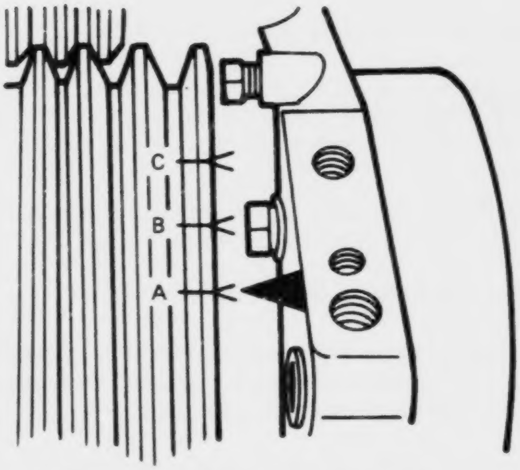


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Figure 3-223. Valve Set Timing Mark.

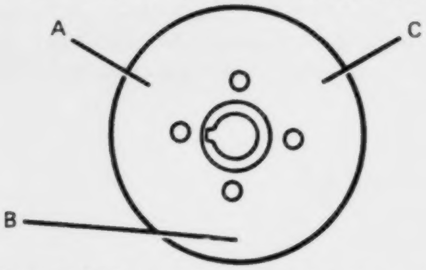

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Figure 3-224. Accessory Drive Pulley Markings.

Table 3-11. Injector and Valve Set Position.

Bar in Direction	Pulley Position		Cyl. Firing	Set Cylinder Injector	Set Cylinder Valve
Start	A	or	1	3	5
Advance to	B	or	5	6	3
Advance to	C	or	3	2	6
Advance to	A	or	6	4	2
Advance to	B	or	2	1	4
Advance to	C	or	4	5	1

Table 3-12. Uniform Plunger Travel Adjustment Limits.

Oil Temp.	Injector Plunger Travel Inch (mm)		Valve Clearance Inch (mm)	
	Adjust Value	Recheck Limit	Intake	Exhaust
Cold	0.170 (4.32)	0.169-0.171 (4.29-4.34)	0.011 (0.28)	0.023 (0.58)
Hot	0.170 (4.32)	0.169-0.171 (4.29-4.34)	0.008 (0.20)	0.023 (0.58)

b. When the engine has been set in proper position for the injector to be adjusted, tighten the adjusting screw until all lash is removed from the injector train. Then tighten the adjusting screw one additional turn to properly seat the links and to squeeze the oil from the socket surfaces. Back the adjusting screw off until the spring washer contacts the stop. Now adjust the zero clearance, use a pound-inch torque wrench and tighten the screw to 5-6 lb-in (0.56-0.68 N·m) torque, zero clearance being defined as the condition where the link is slightly loaded. Always make valve adjustment after injector adjustment. Move to next cylinder as indicated in table 3-13 and repeat adjustments.

Table 3-13. Engine Firing Order.

Right Hand: 1-5-3-6-2-4
(As Viewed from Front of Engine)

NOTE

If torque wrench is not available, zero clearance can be set at point approximately where link is slightly loaded, but just free enough to be rotated by thumb and forefinger.

Hold adjusting screw with screwdriver and tighten locknut to proper torque.

c. Loosen locknut and back off adjusting screw. Insert feeler gage between rocker lever and crosshead. Valve clearances are shown in table 3-12. Turn screw down until lever just touches gage and lock in this position. Tighten locknut to 40-45 lb-ft (54-61 N·m) torque. When using ST-669, torque to 35-40 lb-ft (47-54 N·m).

3-164. Engine Retarder.

a. Install new gaskets and Engine Retarder units to the rocker housings.

NOTE

If studs were removed from rocker housings, replace and tighten to 65-75 lb-ft (88-102 N·m); torque in sequence as shown in figure 3-225.

b. Install the Lifting Eyes and Front bracket, then install the special locking plates on the two studs located in center of each housing. Tighten all nuts to 55-60 lb-ft (75-81 N·m); torque in sequence as shown in figure 3-225.

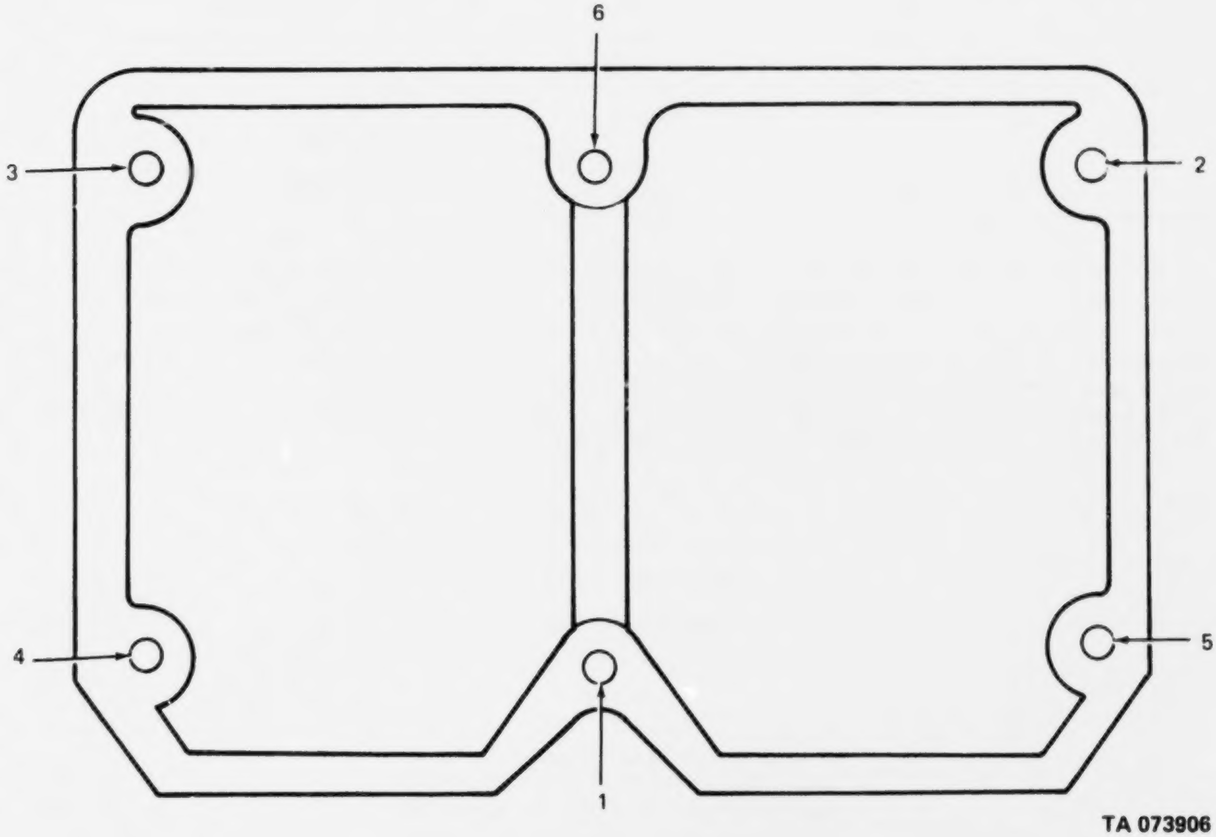


Figure 3-225. Engine Retarder Torque Sequence.

c. Bend the long tab on each special locking plate down over housing surface, bend one short tab up against flat of each hex nut.

d. Engine Retarder Slave Piston Adjustment Procedure.

(1) Loosen and back off locknut. Insert Allen Wrench and back slave piston adjusting screw out of housing until slave piston seats in it's bore.

(2) Slave piston adjustment must be made with the engine stopped (cold or warm) and the exhaust valves closed. Bar the engine in direction of rotation until "A" mark on accessory drive pulley lines up with the timing mark on the gear case cover. With the engine in this position, the exhaust valves of cylinders 1-6 are closed. Insert a .018" (.46 mm) feeler gauge between the slave piston and the crosshead, turn the adjusting screw in until a slight drag is felt on the feeler gauge. Continue turning engine in direction of rotation and set slave piston clearance on cylinders 2-5 and 3-4.

(3) To bleed brake units for immediate operation, manually depress solenoid armature five or six times in succession with engine running to permit oil to fill passages in housing.

(4) Attach electrical harness to terminal in Engine Brake housing.

3-165. Rocker Arm Housing Covers. Position covers and new gaskets on Engine Retarders. Tighten all cover capscrews using combination cork and rubber gaskets to 75-95 lb-in (8.5-10.0 N·m); tighten all cover capscrews using cork gaskets to 12-17 lb-ft (16-23 N·m) torque. Reinstall aftercooler crossover.

3-166. Water Manifold and Thermostat Housing.

a. With O-ring on water manifold connection, slip connection into manifold. Grease new water manifold and thermostat housing sealing rings and place rings in cylinder heads; position and secure water manifolds to cylinder head.

b. Position and secure assembled thermostat housing to front section of water manifold and install water bypass piping.

3-166.1. Coolant Filter Installation Kit No. 5739124.

a. Bend tabs on locks (9) away from two bolts (10). Remove bolts, locks and clamp (8).

b. Aline bracket (7) and clamp (8) to front of exhaust manifold.

c. Aline two locks (9) to bracket (7) and exhaust manifold.

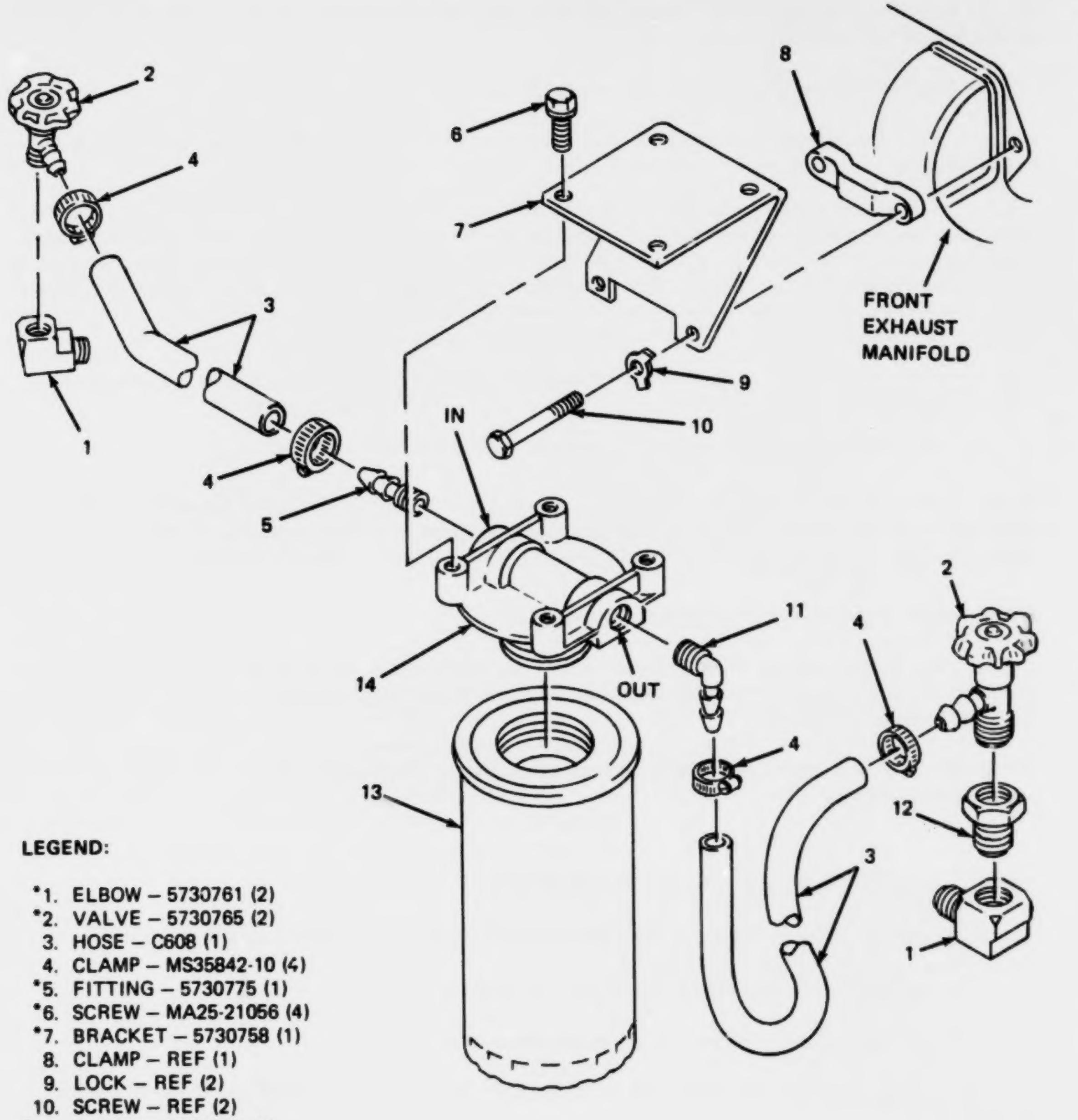
d. Install and torque two bolts (10) to 15-20 lb-ft (20.3-27.1 N·m), then to 40-45 lb-ft (54.2-61.0 N·m).

e. Fold tabs on two locks (9) over heads of two bolts (10).

f. Position head (14) to bracket (7) with OUT port to front of vehicle and IN port facing rear. Insert four screws (6) and tighten.

NOTE

Filter head is aluminum, do not overtighten.


2
4
1
3
4
5
6
7
8
FRONT EXHAUST MANIFOLD
9
10
IN
14
OUT
11
2
4
4
13
12
3
1

LEGEND:

*1. ELBOW – 5730761 (2)
*2. VALVE – 5730765 (2)
3. HOSE – C608 (1)
4. CLAMP – MS35842-10 (4)
*5. FITTING – 5730775 (1)
*6. SCREW – MA25-21056 (4)
*7. BRACKET – 5730758 (1)
8. CLAMP – REF (1)
9. LOCK – REF (2)
10. SCREW – REF (2)
*11. ELBOW – 5730774 (1)
*12. ADAPTER – 5730770 (1)
*13. FILTER – 5730768 (1)
*14. HEAD – 5730769 (1)

*COMMON TO: M915A1

TA 239221 ■

Figure 3-225.1. Coolant Filter and Bracket.

g. Fill filter (13) with clean coolant.

h. Screw filter (13) onto head (14) until gasket seal makes contact, then screw on 3/4 of a turn further. Do not overtighten.

i. Wrap threads of elbow (1), adapter (12) and valve (2) with sealing tape.

j. Install elbow (1) into water pump at port where plug was removed. Elbow should be turned to 12-o'clock position as viewed from front of vehicle. Plug 3013786-description.

k. Install adapter (12) into elbow (1).

l. Install valve (2) into adapter (12). Valve (2) should be turned to 9-o'clock position.

m. Wrap threads of elbow (11) with sealing tape and install into head (14) front OUT port as shown.

n. Wrap threads of second elbow (1) with sealing tape and install into thermostat housing where plug was removed. Elbow (1) should be turned to 1-o'clock position. Plug 3013786 condition description.

o. Install valve (2) into elbow (1). Valve should be turned to 5-o'clock position.

p. Wrap threads of fitting (5) with sealing tape and install into head (14) into rear IN port as shown.

q. Cut hose (3) to fit onto valve (2) and fitting (5). Slide two clamps (4) over hose (3).

r. Slide ends of hose (3) onto valve (2) and fitting (5). Tighten two clamps (4) to secure hose (3) in place.

s. Cut hose (3) to fit onto valve (2) and elbow (11). Slide two clamps (4) over hose (3).

t. Slide ends of hose (3) onto valve (2) and elbow (11). Tighten two clamps (4) to secure hose (3) in place.

u. Open two valves (2) by turning counter-clockwise.

NOTE

Follow-on maintenance action required:

- Refill vehicle cooling system.
- Uncover turbocharger intake.
- Reinstall air cleaner-to-turbocharger intake pipe.
- Start engine and check for leaks, correct as necessary.
- Replace filter every 10,000 miles.

3-169. Rear Cover Plate and Oil Seal.

CAUTION

All surfaces in contact with rear teflon seal must be completely free of oil. Oil on the teflon seal will destroy its sealing properties.

a. Clean the crankshaft seal area with drycleaning solvent.

b. Install the teflon seal in the rear cover (with yellow side facing transmission).

c. Install the rear cover and gasket to the cylinder block.

d. Tighten cover capscrews to 24-29 lb-ft (33-39 N·m) and trim off excess gasket material. Using a step plate and dial, mount an indicator on the crankshaft with the point of the indicator on the rear cover trunnion; measure the alinement between the crankshaft face and the rear cover trunnion at four equidistant points. The rear cover must be alined within 0.005 inch (0.13 mm) total indicator runout (fig. 3-226). If the variation between any two readings exceeds 0.005 inch (0.13 mm), remove the rear cover and check it for warpage or dirt or burrs on its mating surface.

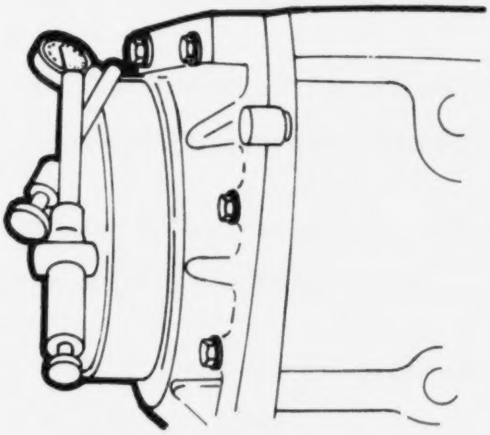


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Figure 3-226. Checking Rear Cover Plate Runout.

3-170. Flywheel Housing Installation.

a. Install new O-ring on rear cover.

b. Position flywheel housing on end of block.

c. Insert nine capscrews into mounting holes.

d. Torque all the capscrews to 30 lb-ft, then to 60 lb-ft, and finally to 90 lb-ft.

3-171. Indicate Flywheel Housing Bore.

a. Draw chalk marks at 12, 6, 9 and 3 o'clock. Attach a dial gage to the crankshaft flange (fig. 3-227).

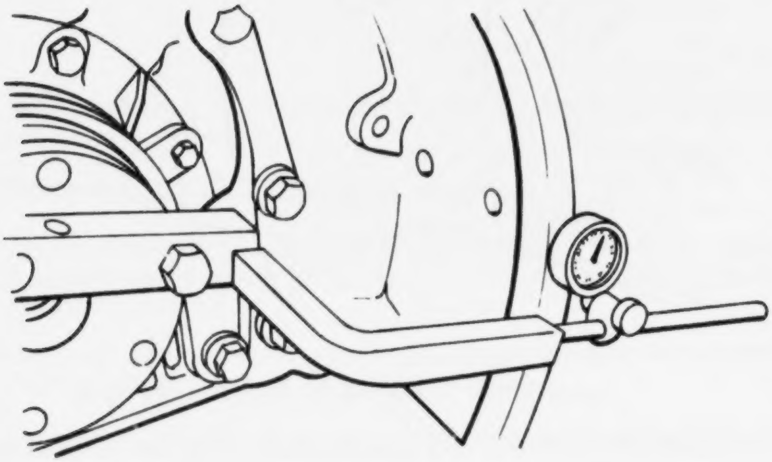
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Figure 3-227. Indicating Flywheel Housing Bore.

b. Check the readings at 9 o'clock and 3 o'clock. If the runout exceeds specifications in table 3-14, move the housing one-half the distance to the center horizontally.

Table 3-14. Flywheel Housing Specifications Inch (mm).

Bore Diameter (For Reference Only)	True Location Tolerance	Face Run Out Tolerance
20.125-20.130	0.008 (0.20 mm)	0.008 (0.20 mm)
(534.27-534.40 mm)	TIR	TIR

c. Check readings at 12 o'clock and 6 o'clock. If runout exceeds specifications, move housing to center vertically.

3-172. Indicate Flywheel Housing Face.

a. Attach an adapter and a dial gage as shown in figure 3-228.

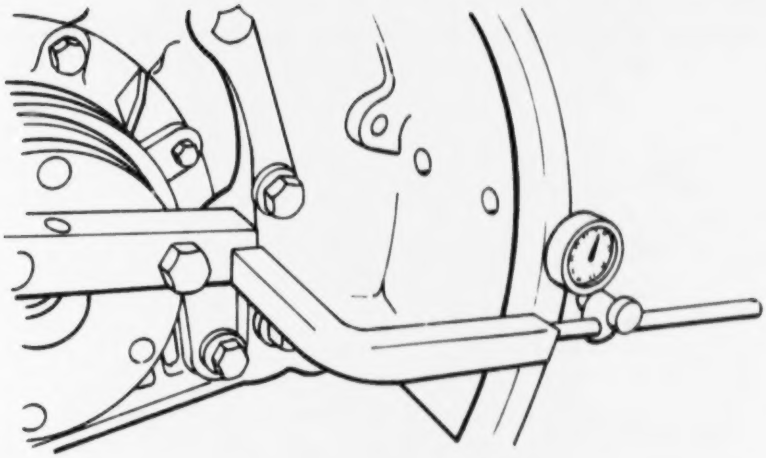

Figure 3-228. Indicating Flywheel Housing Face.

b. Push the crankshaft forward to take up end clearance and turn the crankshaft to obtain readings on housing face. Take up crankshaft end clearance in the same direction each time.

c. Total flywheel housing face run-out must not exceed specifications in table 3-14.

d. If both bore and face run-out readings are within limits and dowels were removed, ream the dowel holes to smallest permissible oversize with a suitable ream fixture and bushings, as required.

e. If it is necessary to correct for housing face run-out after the bore has been alined, remove the housing and recheck the mating surfaces. Then reinstall, realine the capscrews alternately and torque evenly to 150 lb-ft (203 N·m).

3-173. Flywheel Housing Using Wet Seal.

CAUTION

If engine is to be dynamometer tested, the wet seal must NOT be installed until after test. DRY RUNNING WILL DESTROY THIS SEAL.

a. Mount the wet type flywheel housing to the block using new O-rings and capscrews; indicate face and bore (para 3-173 and 3-174).

b. Press a new seal into the seal carrier with the spring-loaded sealing lip toward the flywheel until it seats in the carrier.

c. Position the seal carrier with a new gasket to the flywheel housing. Secure snugly with Nylok capscrews. Indicate the seal carrier to the crankshaft; it must be centered within 0.006 inch (0.18 mm) T.I.R.

d. Torque the seal carrier to flywheel housing capscrews to 8 lb-ft (11 N·m). If the access cover plate was removed, reinstall and secure it using copper washers and capscrews.

3-174. Oil Pan.

a. Two oil pan capscrew holes at the flywheel end of block are reamed for body-fit bolts. If not previously installed, install the bolts in the block.

b. Install a new oil pan gasket to the cylinder block or pan.

(1) When using new "tab-lock" gasket, paint oil pan flange with lubriplate. Start at either end of the oil pan, lay gasket sections on the oil pan flange. Proper assembly is assured by matching letters located on the end of each gasket section.

(2) Insert several capscrews through the gasket and oil pan flange capscrew holes to line it up. When the gasket sealing compound dries, remove the guide capscrews.

c. Check the oil pan screen to make certain that it is properly assembled and that all screws are tight.

d. Assemble the aluminum oil pan to block using flat steel washers and capscrews. Torque to 31-34 lb-ft (42-46 N·m).

e. If a new pan is being installed prior to installing flywheel housing:

(1) Position it so the buttress-end of pan is flush with the end of block and check with a straight-edge.

(2) Ream the holes to next oversize and install oversize body-fit bolts.

3-175. Oil Suction Tube.

a. Start the fitting on the oil pump adapter and oil pan flange. Do not tighten.

b. Position the oil pan flange with a new gasket to the oil pan. Do not tighten the capscrews.

c. Tighten the fitting 1-1/4 turn from finger-tight.

d. Torque the suction flange to the oil pan capscrews to 20 lb-ft (27 N·m). Tighten the fitting against stop on the suction flange.

e. Mount the oil suction line clamp on the block with the appropriate oil pan capscrew.

3-176. Flywheel.

a. Install the flywheel:

(1) Screw two studs, 5/8-18 x 6 inches long into the crankshaft flange as guides. Install the flywheel over the studs, match the dowel holes in the flywheel and crankshaft.

(2) Remove the guide studs and position the hard flatwasher on the self-locking capscrew, tighten alternately until snug, to pull the flywheel up evenly. Tighten all capscrews to 70 lb-ft torque, then to 140 lb-ft torque and finally to 200-220 lb-ft (271-298 N·m) torque. Refer to figure 3-229 for torquing sequence.

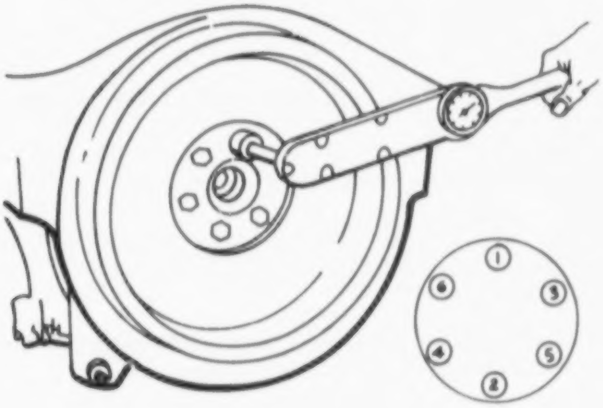

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Figure 3-229. Flywheel Torquing Sequence.

b. Indicate flywheel face.

(1) Shift gage to face of flywheel (fig. 3-230).

(2) Total indicator reading must not exceed 0.0005 inch (0.013 mm) per inch (25.4 mm) of diameter of outer 1/3 of face radius.

NOTE

If total indicator readings exceed the limits listed in *b (2)* above, remove flywheel; clean flywheel and crankshaft flange faces, reinstall and repeat the checks.

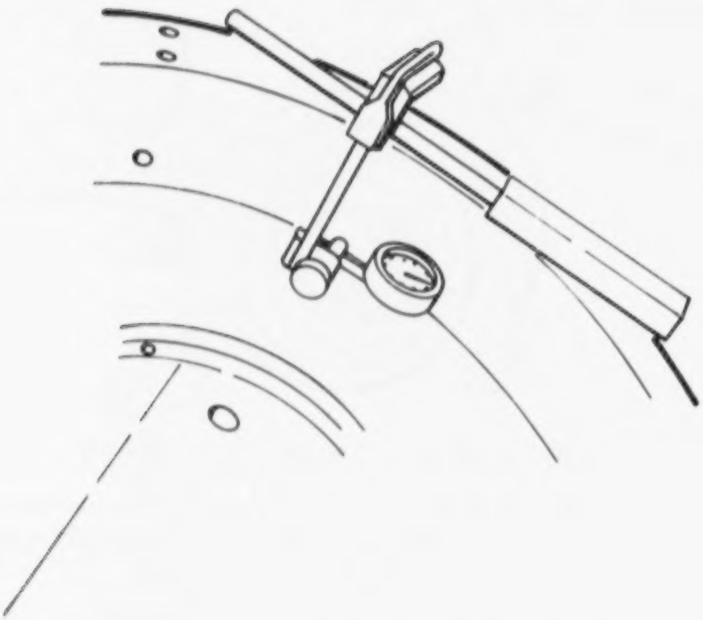

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Figure 3-230. Indicating Flywheel Clutch Face.

3-177. Vibration Damper and Pulley. Aline capscrew holes and install pulley vibration damper assembly to crankshaft. Coat capscrews with clean lubricating oil, secure pulley and damper assembly to crankshaft and torque all capscrews to 20 lb-ft, then 60 lb-ft, and finally to 85 lb-ft (115 N·m).

CAUTION

Do not use any lubricant on pulley or crankshaft mating surfaces. Wipe with clean, dry cloth.

Position a dial gage to gear case cover and rest the arm on the outer machined surface to check eccentricity and on inner machined surface of outer member to check wobble. Run-out must not exceed 0.0025 inch (0.064 mm) per 1-inch radius of damper (as measured from the center of the damper). Crankshaft must be kept at front or rear limit of thrust clearance while wobble is being checked.

3-178. Accessory Drive Pulley.

NOTE

Accessory drive gear timing may be checked visually through 3/8 inch pipe plug hole in the front of the gear cover (fig. 3-231).

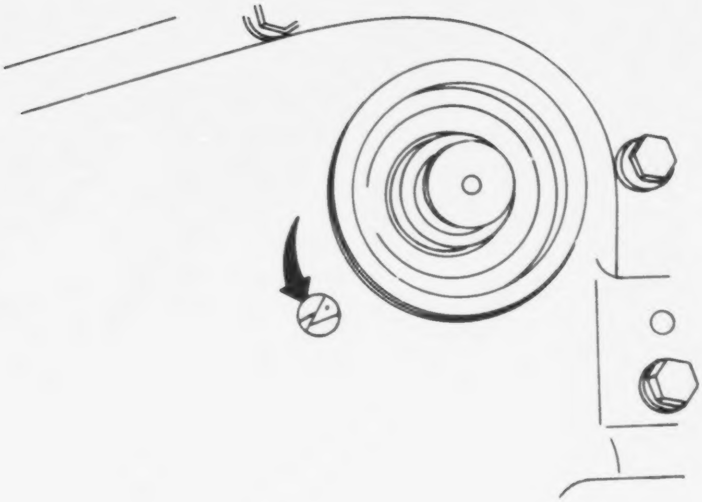

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Figure 3-231. Camshaft and Accessory Drive Gear Timing Marks.

a. Install accessory drive oil seal in gear cover. Put number to front of engine. The accessory drive oil seal fits flush to the lip in the case.

CAUTION

LDL-TFE oil seal and shaft surface must
be clean and dry of any lubricant.

b. Install roll pin in accessory drive shaft, rounded end in shaft.

c. Install 3/8-inch pipe plug in inspection hole in front of gear cover. Tighten to 20 lb-ft (47-61 N·m) torque.

d. Remove any lubricant that may be present on hub wear sleeve of accessory drive pulley. Apply an even bead of locktite to pulley hub bore at sleeved end. Install pulley hub bore over front end of shaft, alining pulley keyway with dowel in shaft. Press pulley onto shaft to a point where hub face contacts shoulder on shaft. (The pulley hub wear sleeve will be pushed through the oil seal lip at the same time the pulley is pressed on the shaft).

e. Install keyway seal into pulley keyway allowing one end of the "L"-shaped seal to penetrate pulley keyway, and other end to seat against shaft shoulder (fig. 3-232).

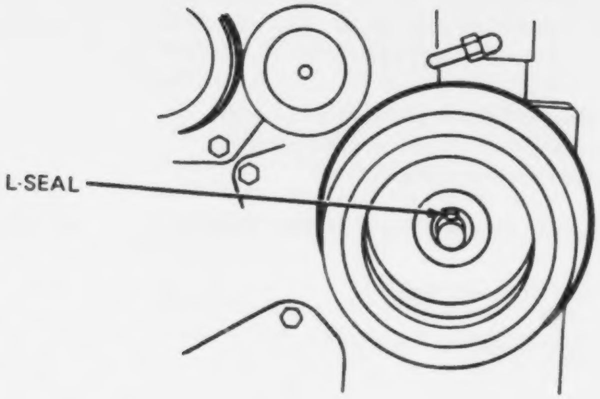

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Figure 3-232. Installing the Keyway "L"-Seal.

f. Install washer and locknut allowing keyway seal to be crushed against shaft shoulder by retaining washer. Tighten locknut to 90-100 lb-ft (122-135 N·m) torque.

3-178.1 Accessory Drive.

NOTE

Bearings or bushings must not turn in housing retaining bore. If old bearing or bushing has turned and ruined housing, replace housing. Housing bore must be clean before pressing new bearing or bushing in place.

Seal effectiveness depends on surface where seal seats. Check hub sleeve surface for wear. Replace sleeve if necessary. Before installing new seals, lubricate with clean lubricating oil.

When installing thrust washers on accessory drives, thrust side, identified by grooves, is installed away from housing. Steel backing against the cast iron housing will reduce the possibility of thrust washers turning. Improper installation of these washers will result in excessive wear and increased end play, causing early failure of accessory drive assembly.

Fuel Pump or Compressor Drive (Figure 3-232.1).

Disassembly.

NOTE

A splined coupling is used on air compressor drive. A buffer type coupling is used on fuel pump drive.

a. Using ST-1249 coupling puller, pull coupling (10) from shaft (5).

b. Press shaft and gear assembly from housing (6).

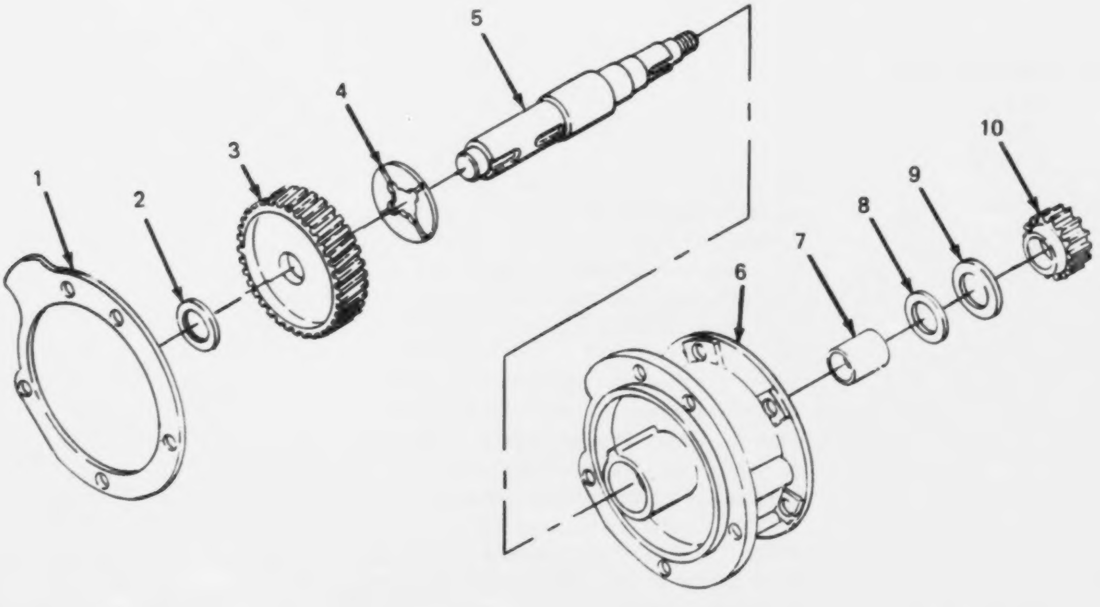
c. Press shaft (5) from gear (3) and remove keys from shaft.

Inspection.

a. Check bushing (7) in drive housing (6). Replace if worn beyond specifications shown in figure 3-232.4.

b. Check shaft (5) for wear, distortion, or galling on bushing mating surfaces. Outside diameter of shaft must not be worn more than 1.310-inch (33.27 mm).

c. Replace thrust washers (4 and 8) if worn or damaged.



1. Gasket
2. Oil Slinger
3. Drive Gear
4. Thrust Washer
5. Shaft
6. Housing
7. Bushing
8. Thrust Washer
9. Clamping Washer
10. Coupling

TA 239512

Figure 3-232.1 (N10910) Fuel Pump Drive.

WARNING

Compressed air used for blowing away chips, dirt, etc., must leave nozzle at less than 30 psi (207 kPa) to prevent personal injury. Be certain that nozzle is rated to provide a maximum of 30 psi (207 kPa). Be sure to wear safety goggles when using compressed air. Compressed air and particles moved by compressed air can cause damage to your eyes.

Improper cleaning methods and use of unauthorized cleaning liquids or solvent can injure personnel. Refer to TM 9-247, and TM 9-208-1.

d. Clean all parts in approved cleaning solvent and blow dry with compressed air.

Assembly.

a. Install shaft (5) through housing (6) and bushing (7).

b. Slip on large thrust washer (4) with grooved side away from housing (6).

c. Install key and press drive gear (3) on shaft (5).

d. Turn assembly over, slip on small thrust washer (8) with grooved side away from housing (6).

e. Slip on clamping washer (9) and install coupling key.

f. Press on coupling (10) with hub end down.

g. Install oil slinger (2) over gear end of shaft (5).

NOTE

Check end clearance with unit assembled. It should be within specifications shown in figure 3-232.4.

Dowel Pin Shaft (Figure 3-232.2).

NOTE

Can be used to replace 121940 and 199969 Accessory Drive Shafts.

Disassembly.

a. Remove capscrew (10) and washer (9).

b. Using ST-1249 coupling puller, pull coupling (8) from shaft (11).

c. Press shaft (11) and gear (3) assembly from housing (5).

d. Remove thrust washers (4 and 7) and washer (12).

e. Remove gear (3) from shaft (11).

f. Remove seals (1 and 6) and dowel pins (2).

g. Remove bushing (13) from housing (5).

Inspection.

Refer to Fuel Pump or Compressor Drive Inspection paragraph (page 3-280.xx) for inspection procedures.

Assembly.

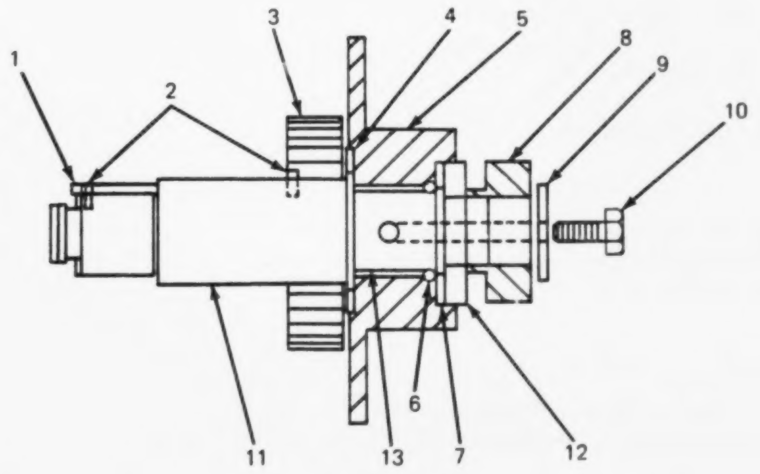
a. Install new bushing (13). Be certain oil hole in bushing is aligned with oil hole in housing (5).

b. Remove excess oil from dowel pin holes.

c. Install seals (1 and 6) and dowel pins (2) in shaft (11).

d. Align gear (3) keyway with dowel pin (2) and install gear on shaft (11), near face of gear contacting shoulder on shaft.

e. Place front thrust washer (4) over rear of shaft (11). Bearing face of washer must contact back of gear (3). Be sure to place inside diameter of thrust washer over outside diameter of trunnion on shaft (11).



1. Seal
2. Dowel Pins
3. Gear
4. Thrust Washer
5. Housing
6. Seal
7. Thrust Washer
8. Coupling
9. Washer
10. Capscrew
11. Shaft
12. Washer
13. Bushing

TA 239513

Figure 3-232.2 (N10911) Dowel Pin Shaft Accessory Drive.

f. Install shaft (11), gear (3) and thrust washer (4) assembly through housing (5). Steel backing of thrust washer must contact housing at front of bushing bore.

g. Place rear thrust washer (7) on shaft (11). Steel backing of thrust washer must face front of shaft.

h. Install thrust washer (12) on shaft (11). Front of thrust washer must contact bearing face of rear thrust washer (7).

i. Install coupling (8), trunnion end to front of shaft (11).

j. Install washer (9) and capscrew (10). Torque capscrew 30 to 35 ft lbs (41 to 47 N·m).

Fuel Pump/Hydraulic Governor Drive (Figure 3-232.3).

Disassembly.

a. Remove governor drive assembly snapring (11), ball key and collar (13).

b. Press on shaft (12), opposite gear end, and remove all units from housing (14).

c. Remove drive gear (2) and support assembly from reservoir (21).

d. Remove drainplug, dipstick, vent plug and elbow.

e. Remove locknut (22), flat washer (23) from shaft (31).

f. Using ST-1249 coupling puller, remove coupling (24). Lift out key (30).

g. Remove spacer (25) and governor drive gear (26).

h. Press on small end of shaft (31) to remove shaft from support (3) and large end of shaft to remove drive gear (2).

i. Remove keys (32) from shaft (31) keyways.

j. Remove snapring (27) from support (3). Invert support and press out rear bearing (28) and oil seal (29).

Inspection.

a. Check bearing for worn race or rough action.

b. Check gears for chipped, broken teeth or uneven wear.

c. Inspect governor shaft housing oil holes to make certain they are open and clear of foreign matter.

d. Inspect support (3) and reservoir (21) for cracks, breaks or rough mating surfaces.

e. Replace all damaged, worn or defective parts as necessary.

Assembly.

a. Lubricate outside of seal (29) and press into support (3) from large end. Open end of seal must be facing down.

b. Lubricate rear bearing (28) and press into support (3). Insert snapring (27) with flat side down.

c. Lubricate shaft (31) and place key (32) in shaft (31) keyway. Press shaft into flat side of gear (2) until shoulder seats on gear face.

d. Press small end of shaft assembly into large end of support (3). Press governor drive gear (26) onto shaft (31) until it bottoms on bearing (28).

e. Insert key (30) and press on coupling (24). Shoulder of coupling goes against gear (26) unless a spacer (25) is used.

f. Install flat washer (23), screw on and tighten locknut (22).

g. Position reservoir (21) in vise with governor drive studs (17) up. Install dipstick, vent plug, drainplug and elbow.

On governors with 2:1 gear ratio:

h. Install shaft (12) with splined end up, and collar (13) into housing (14).

i. Lubricate ball key and insert in drive shaft and install snapring (11).

j. Align ball key with collar (13).

k. Invert assembly and press on gear (9). Allow end clearance of 0.003 to 0.006 inch (0.08 to 0.15 mm).

On governors with 3:1 gear ratio:

l. Press governor two-piece drive shaft (12) into washer flush with bottom side. Note relief in washer to start shaft.

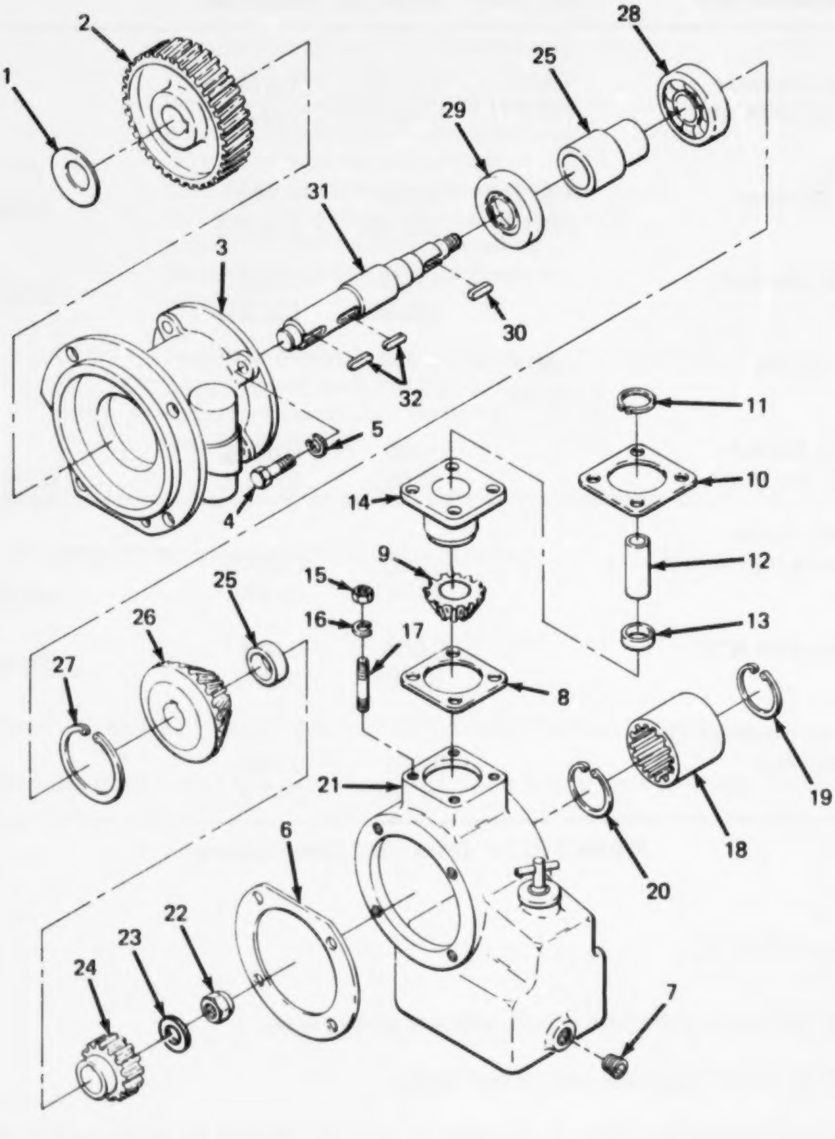
m. Press shaft assembly into cylinder until shoulder on shaft is flush with end of cylinder. Slide assembly into governor drive housing (14) so flat washer rests on bronze bushing.

n. Invert assembly and install ball key, collared washer (13) and snapring (11). Press on end of cylinder until flat washer is against bronze bushing.

o. Press gear into position allowing end clearance of 0.003 to 0.006 inch (0.08 to 0.15 mm).

p. Put gasket (8) in place and install drive gear and housing assembly to serial number side of reservoir (21). Large oil hole in housing must be at top.

q. Install slinger (1) over gear end of shaft.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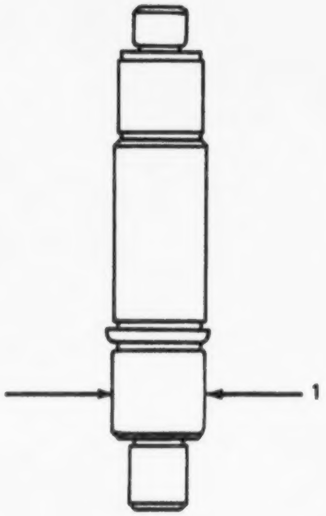
1. Slinger
2. Drive Gear
3. Support
4. Capscrews
5. Lockwashers
6. Gasket
7. Pipe Plug
8. Gasket
9. Gear
10. Gasket
11. Snap Ring
12. Shaft
13. Collar
14. Housing
15. Nuts
16. Lockwashers
17. Studs
18. Coupling
19. Snap Ring
20. Snap Ring
21. Reservoir
22. Locknut
23. Flatwasher
24. Coupling Gear
25. Spacer
26. Drive Gear
27. Snap Ring
28. Bearing
29. Oil Seal
30. Key
31. Shaft
32. Keys

TA 239514

Figure 3-232.3 (N10912) Fuel Pump, Hydraulic Governor Drive (Woodward Governor).

Ref. No.	Measurement	Worn Limit Inch (mm)	New Minimum	New Maximum
1.	**Shaft**			
	Outside Diameter (Bushing Location)	**1.310** **[33.27]**	1.3115 [33.312]	1.312 [33.32]
	Bushing			
	Inside Diameter	**1.321** **[33.55]**	1.316 [33.43]	1.319 [33.50]
	Outside Diameter		1.449 [36.80]	1.450 [36.83]
	Out-of-Round	**0.002** **[0.05]**		
	Press-Fit Between Housing and Bushing		0.002 [0.05]	0.0045 [0.11]
	Accessory Drive			
	End Clearance NH/NT		0.002 [0.05]	0.0045 [0.26]
	End Clearance NTC		0.004 [0.10]	0.024 [0.61]
	Hydraulic Governor Drive			
	End Clearance		0.003 [0.08]	0.006 [0.15]



TA 239615

Figure 3-232.4 Drive Unit Specifications.

Drive Pulleys.

Inspection.

a. Check for cracks and chips in hub, web and groove areas.

b. Check for wear in grooves and oil seal sleeve.

c. On two-piece pulleys, check for stripped or distorted threads on sheave and in capscrew holes.

WARNING

Compressed air used for blowing away chips, dirt, etc., must leave nozzle at less than 30 psi (207 kPa) to prevent personal injury. Be certain that nozzle is rated to provide a maximum of 30 psi (207 kPa). Be sure to wear safety goggles when using compressed air. Compressed air and particles moved by compressed air can cause damage to your eyes.

Improper cleaning methods and use of unauthorized cleaning liquids or solvent can injure personnel. Refer to TM 9-247, and TM 9-208-1.

d. Clean parts in an approved cleaning solvent and dry with compressed air.

e. Replace all damaged, worn or defective parts as necessary.

Repair.

If wear on sleeve is visible:

a. Remove worn oil sleeve by splitting with chisel. Do not damage pulley hub.

b. Press new sleeve onto pulley hub with mandrel, until it is flush to 0.015 inch (0.38 mm) below face of hub.

3-179 Remove Engine from Stand.

a. Attach lifting arrangement and remove engine from stand; mount front and rear supports to engine.

b. Remove engine and stand support plates from water header and replace with proper gaskets and cover plates.

3-180. Piston Cooling Nozzles.

a. Lubricate new O-rings with clean lubricating oil and position on nozzle. Be sure O-rings are not twisted in groove.

NOTE

Do not soak O-rings in oil.

b. Insert nozzles in block and secure. Using a screwdriver adapter torque slotted screw to 5-8 lb-ft (7-11 N·m). Torque hexhead capscrews to 10 lb-ft (14 N·m).

3-181. Starter. Install the starter and torque bolts to 135-150 lb-ft (183-203 N·m). Refer to TM 9-2320-273-20.

3-182. Dipstick. Install the dipstick and hand hole cover using a new gasket.

3-183. Exhaust Manifold.

NOTE

When assembling sections of the exhaust manifold, it may be necessary to apply heat to mating collars to expand for ease of assembly.

a. Assemble sections of exhaust manifold and install new steel exhaust manifold gaskets. Side of gasket marked "OUT" must be installed outward or next to manifold.

b. Coat capscrew threads with anti-seize compound.

c. Torque mounting capscrews to 25 lb-ft (34 N·m). Bend lockplate tangs up against capscrew heads.

3-184. Water Pump and Idler Pulley.

a. Using new gasket, position water pump and idler assembly to block. Torque as follows:

(1) Torque in rotation to 10 lb-ft (14 N·m).

(2) Repeat rotation torque to 20 lb-ft (27 N·m).

(3) Final torque in rotation to 30 lb-ft (41 N·m).

b. Position belt over water pump, idler and accessory drive pulleys. Tighten idler adjusting screw to obtain 120-140 lb (534-623 N) belt tension.

c. Secure idler shaft to bracket with flatwasher and locking nut. Tighten to 50 lb-ft (68 N·m) torque. Back off adjusting screw 1/2 turn.

3-185. Compressor Water Lines. Install water supply and drain lines to compressor, cylinder block and water bypass connections. Tighten just enough to bring brass sleeves snugly against nuts; this will compress rubber grommets and provide a positive seal.

3-186. Turbocharger.

a. Coat turbocharger mounting stud threads with anti-seize compound. Place gasket on exhaust manifold with convex side toward turbocharger.

b. Install turbocharger to exhaust manifold and secure with hug-lock nuts. Oil drain line fitting must always be pointed directly downward or within 30° of that position.

c. Connect No. 6 oil inlet line from top of turbocharger to oil cooler.

d. Connect oil drain line or equivalent size tubing from turbocharger to large boss on side of cylinder block.

NOTE

If turbocharger "vee clamp" is loosened to aline oil drain line, tighten to 30-32 lb-in (3.4-3.6 N·m) torque.

e. Install air intake crossover between turbocharger outlet and air intake aftercooler. Install new rubber tubing connection and T-bolt type clamps. Tighten T-bolt clamps to 65-75 lb-in (7.4-8.5 N·m).

3-187. Oil Cooler/Filter Assembly and Connections.

a. Mount the angle bracket to the engine block. Do not tighten mounting bolt.

b. Using a new water header gasket and support gasket, position the oil cooler assembly on the engine while simultaneously installing water transfer pipe in water manifold.

c. Tighten the capscrews and lockwashers at the water header connection and the support to 30 lb-ft (41 N·m) torque.

d. Secure angle bracket to oil cooler cover and tighten angle bracket capscrew at the engine block.

e. Secure water transfer tube to the water manifold with one lockwasher and capscrew.

f. Connect the oil supply hose from the cooler to the turbocharger.

3-188. Power Steering Pump.

Install power steering pump with reservoir attached. Use a new adapter to oil pump gasket and apply silicone RTV sealant to the pump mounting surface before installation. Install with two capscrews and washers. Connect pressure and return lines and fill reservoir. (See TM 9-2320-273-20.)

3-189. Breather Tube. Install breather tube to rocker housing cover and secure to block with clamp.

3-190. Engine Dress. Specific instructions covering the installation of engine dress components appear in TM 9-2320-273-20 and TM 9-2320-273-34.

a. Install the fan clutch. Torque the capscrews to 68-75 lb-ft (92-102 N·m).

b. Install the fan drive belt set. Adjust the belt tension at 110 lbs.

c. Install the throttle linkage bracket and accelerator return spring.

d. Install the fan clutch actuator and bracket if removed.

e. Install the air compressor governor.

f. Install the alcohol evaporator, ether quick-start and mounting bracket to the engine.

g. Install the ether quick-start safety switch, oil pressure, low oil pressure warning, engine temperature sending units and fuel lines and fittings.

h. Install the engine electrical harness. (See TM 9-2320-273-20).

i. Install the Engine Retarder microswitch on the fuel pump.

j. Install the alternator bracket, alternator, and adjusting rod.

k. Connect the leads to the electrical components.

l. Install the heater hoses, nylon lines and tubing.

m. If the vehicle is equipped with an optional engine coolant heater, install hoses, lines and fittings, refer to TM 9-2320-273-20.

NOTE

Replacement Service Engines — Replacement service engines are built up engines furnished by the vehicle manufacturer. The engines are prepared for installation in a M915 truck, less the electrical harness. A conversion kit with instructions, accompanies the service engine. This kit can be utilized to adapt the engine as received, to the configuration required for installation in the M916, M917, M918, M919, and M920.

3-191. Engine Testing. Engine break-in and testing are accomplished simultaneously. Break-in on a new or rebuilt engine is necessary because it provides an operating period during which moving parts acquire their final finish and mating surfaces reach a full seat. Engine testing helps detect possible assembly errors, need for adjustments as engine "break-in," and establishes a period for final adjustments for best engine performance.

3-192. Installation of Engine on Dynamometer.

a. Place engine on dynamometer test stand, secure engine mounting pads to engine support risers.

b. Position dynamometer drive shaft flange to engine flywheel. Check for proper alinement per manufacturer's instructions.

c. Connect water supply and return hose to the water cooling arrangement.

d. Attach fuel consumption measuring device to engine.

e. Connect throttle linkage instruments, exhaust piping and air intake piping to engine.

f. Install blow-by checking tool in crankcase breather opening or special rocker cover. Use water manometer and fill to "O" mark at middle of scale. Close all openings that would allow blow-by pressure to escape.

3-193. Priming the Fuel System.

a. Fill fuel tanks and filter(s) with clean diesel fuel oil. With PTG (AFC) fuel pump, fill the pump through plug next to tachometer drive with clean fuel.

b. If injector and valve or other adjustments have been disturbed, be sure they have been properly adjusted before starting engine.

3-194. Priming the Lubricating System.

CAUTION

Remove the turbocharger oil supply line and lubricate the bearing with approximately 2-3 oz (60 ml) of clean engine lubricating oil. Fill the oil supply line with engine oil. Reconnect oil supply line.

a. Fill crankcase to "L" (low) mark on dipstick.

b. Remove plug from head of lubricating oil filter on cooler housing or gear case to prime system.

CAUTION

Do not prime engine lubricating system from bypass filter.

c. Connect a hand or motor-driven priming pump line from source of clean lubricating oil to plug boss in housing. Prime until a 30 psi (207 kPa) maximum pressure is obtained.

d. Crank engine at least 15 seconds (with fuel shutoff valve closed) or disconnect to prevent starting, while maintaining external oil pressure at a minimum of 15 psi (103 kPa).

e. Remove external oil supply line and replace plug.

f. Finish filling crankcase to "H" (high) mark on dipstick. Check for leaks.

3-195. Pre-Run Start-Up.

a. Disconnect the turbocharger oil drain line.

b. Start the engine and maintain rpm at low idle.

c. Open the coolant supply to the engine water connection.

d. Observe the turbocharger oil drain. Oil should flow in 10-15 seconds. If no oil flows in 30 seconds, shut down the engine and correct the fault.

e. Reconnect the oil drain line when flow is established.

f. Introduce water to the dynamometer per manufacturer's instructions.

g. Check all tubing, hoses, lines, fittings and plugs for leaks. Correct as necessary.

h. Shutdown the engine.

CAUTION

After maintenance or if an engine has been in storage, prior to initial start-up:

(1) Disconnect the oil supply line at the turbocharger.

(2) Lubricate the turbocharger with 2-3 oz (60 ml) of clean engine oil.

(3) Fill the turbocharger oil supply line with clean engine oil.

(4) Connect and tighten the oil supply line at the turbocharger.

Section XXXI. DYNAMOMETER TESTING

3-196. General. This section contains instructions and standards for run-in and test of the Cummins NTC-400 Diesel Engine on an engine dynamometer to ensure that a new or newly rebuilt engine will deliver its designed performance after installation.

NOTE

Any engine-type dynamometer with adequate capacity can be used. Dynamometers must be accurately calibrated.

3-197. Engine Rating and Performance.

a. Maximum Horsepower Rating. The Cummins NTC-400 engine is 400 hp at 2100 rpm. This performance would be delivered at sea level, 60°F (16°C) intake air temperature and 29.92 inch hg (mercury barometric pressure) (760.0 mm).

b. Where it is necessary to deaerate because of high altitude operation, the deaerating may be done by reducing maximum governed rpm or maximum fuel rate.

c. Turbocharged engines do not require fuel deaerating below maximum altitudes shown in table 3-14. Above maximum altitudes, deaerate at 4 percent for each 1000 ft (305 m) additional altitude and 1 percent for each 10°F (6°C) air temperature rise above 12°F (52°C).

d. New or newly-rebuilt engines during dynamometer tests are not required to deliver more than 96 percent of maximum horsepower at power checks.

3-198. Break-In Run.

a. Initial Starting. Start the engine and idle at approximately 800 rpm no-load for 5 to 10 minutes. Check the oil pressure and water circulation; look for leaks.

Table 3-15. Dynamometer Test Chart.

Engine	HP @ RPM	Rated HP @ RPM · 500 Ft-Alt	Fuel Rate LB/HR	Air Manifold Pressure IN/HG	Altitude Max. HP Alt	Crankcase Pressure With Turbo.	Phase 1 To Temp. HP @ RPM	Phase 2 15 Min. HP @ RPM	Phase 3 15 Min. HP @ RPM	Phase 4 15 Min. HP @ RPM	Power Check 5 Min. HP @ RPM	Torque Ft/Lb Sea Level	Torque Ft/Lb 500 Ft Alt.
NTC 400	400 @ 2100	400 @ 2100	150	41/49	12,000	VT50 12	21 @ 1575	300 @ a100	340 @ 2100	360 @ 2100	383 @ 2100	1000	1000

NOTE

Turbocharged engines do not require fuel deaerating below altitude shown in column entitled "Rating @ Altitude Maximum." Above maximum altitude, deaerate at each 1,000 ft (304.8 m) additional altitude by 4 percent. Crankcase pressure is given in inches of water. Percent of HP @ RPM ratings for break-in phases are established as follows:

Phase 1 – 50% HP @ 75% RPM

Phase 2 – 75% HP @ 100% RPM

Phase 3 – 85% HP @ 100% RPM

Phase 4 – 90% HP @ 100% RPM

Power Check – 96% HP @ 100% RPM

b. *At Each Phase*

(1) Apply dynamometer load to (±10%) horsepower at (±5%) speed shown in table 3-15.

(2) Check crankcase pressure (blow-by) with 3375150. If pressure continues to drop, reduce run-in time by half; otherwise, run engine for time period shown on dynamometer chart.

c. *At Phase 1*

(1) Run engine until normal oil operating temperature has been obtained.

(2) Add lubricating oil to bring level up to "H" mark on bayonet gage; allow oil temperature to stabilize.

d. *At Phase 2.* Set engine idle, governed speed and fuel rate.

e. *At Phase 3.* If blow-by rises, reduce load to preceding phase and run for 30 minutes; then return to original phase specifications.

f. *At Phase 4.*

(1) Run at speed and horsepower indicated.

(2) Check for leaks and tighten all exposed capscrews.

(3) Recheck the valves and injectors.

NOTE

Readjustment after 1 hour operation is necessary to assure lowest smoke potential and avoid excessive injector train loads.

3-199. Power Check.

a. Run engine at rated speed for 5 minutes. It should develop 96 percent of rated horsepower at standard fuel rate. Check crankcase pressure (blow-by). If pressure exceeds value shown in table 3-15, reduce engine speed and load to preceding phase; run engine 30-45 minutes.

b. Repeat procedure described above until engine develops 96 percent rated horsepower at standard fuel rate within permissible crankcase pressure limit.

c. After power check is completed, remove pipe plugs in naturally aspirated engine cyldiner heads and install vent plugs. On turbocharged engines connect aneroid, if used.

3-200. Checks During Run-In Test. During the period of engine run-in, the following checks should be made frequently.

a. *Lubricating Oil*

(1) Lubricating oil pressure should remain at or near a constant figure at constant engine speed and load (table 3-15) after normal operating temperature has been reached. Abnormally high pressures may indicate blocked lubricating oil lines. Abnormally low pressures indicate an insufficient supply of lubricating oil from the pump or increased oil clearances which may be due to bearing failure.

(2) If oil temperature rises sharply above 225°F (107°C) shut down engine and correct as necessary.

(3) New lubricating oil filter elements will absorb oil; therefore engine must be shut down after 5 or 10 minutes of operation and additional oil added to bring oil level to "H" mark on the dipstick. Check the oil level every phase during run-in test.

b. *Smoke Level Check*

(1) Engine must be at normal oil operating temperature.

(2) Apply dynamometer load as rpm is increased; (shift to direct drive gear when chassis dynamometer is used) until rated rpm and horsepower is reached and load is stabilized. Refer to table 3-15.

(3) Using 0-20 scale on opacity meter, zero the meter and place on exhaust stack(s); record readings. Remove meter after readings are completed.

NOTE

An accurate smoke reading can usually be obtained in 10 to 15 seconds.

(4) Increase load until rpm is reduced to 60 percent of rate rpm.

(5) Recheck zero on opacity meter, place on exhaust stack, record readings and remove meter.

(6) Reduce load and rpm.

(7) Accelerate to rated rpm, no-load (full acceleration should occur in 3-5 seconds). Return to idle.

(8) Using 0-100 scale on opacity meter, zero the meter and place on exhaust stack.

(9) Accelerate to rated rpm, no-load; record the highest opacity reading. Remove the meter.

Table 3-16. Normal Lubricating Oil Pressure.

Idle Speed PSI (kPa)	Rated Speed PSI (kPa)
5/20 (34-138)	40/75 (276/517)

c. Engine Coolant. After the engine is started, add coolant as necessary to completely fill cooling system and replace entrapped air. Coolant should not exceed 200°F (93°C) or drop below 160°F (71°C) during engine operation. Do not turn off immediately after a load run. Heat stored in the iron masses will boil coolant in the jackets if air and coolant circulation is immediately stopped while engine is hot. Allow engine to idle for a few minutes before shutting down.

d. Engine Fuel Rate. Return fuel from injector drain is routed through float tank so when float tank is filled, float valve opens and allows return fuel flow to flow meter. Make-up fuel or amount of fuel being consumed by engine will flow through flow meter thus showing rate of fuel consumption in pounds per hour.

e. Blow-By Readings

(1) Manometer readings must be taken frequently during run-in test so mechanic will note any blow-by increase at a given speed and load. If there is any indication of blow-by increase, engine speed must be reduced for a few minutes and then brought back to the original setting.

(2) During each power check, keep a constant check on the manometer; if pressure rises, more run-in is required. Representative pressure limits for engine running at governed speed and pulling 96-100 percent of rated horsepower are given in table 3-16. If pressure is greater than values listed at end of testing period, engine should be checked as follows:

NOTE

Turbocharged engines: Operate 30 minutes extra at 96-100 percent rated load and rpm. If there is no rapid change in excess of 2 inches (50.8 mm) of water and reading does not exceed 100% of representative pressure, blow-by is acceptable. Manometer readings not exceeding 0.3 inch (7.62 mm) surge are desirable.

Section XXXII. ON-ENGINE PUMP ADJUSTMENT.

3-201. Pump Hookup. If the fuel pump has been removed from the engine for calibration, proper hookup is necessary.

a. Install fuel pump to compressor with new gasket and rubber buffer.

b. Squirt some clean lube oil into gear pump inlet hole. This aids gear pump fuel pickup.

c. Connect the fuel pump line from the pump shutoff valve to the fuel manifold on the rear of engine.

d. The throttle lever linkage should not be connected to the throttle lever, thus leaving the throttle free for pump adjustments.

e. Install an accurate tachometer to fuel pump tachometer drive shaft connection.

f. Connect the shutoff valve electrical connections properly, leaving the manual control button in a closed position (screwed out).

g. Connect the pump cooling line to the check valve elbow on gear pump.

3-202. Checking and Adjusting the Fuel Pump on the Engine. Before making fuel system checks or adjustments on engine, be sure the following rules are observed.

a. Engine is at operating temperature. Fuel temperature is not above 110°F (43°C).

b. Engine parts are in good condition. Timing, valves and injectors are properly adjusted.

c. Instrumentation (gages and tachometers) must have high accuracy.

CAUTION

Do not alter pump settings to satisfy gages and tachometers of unknown accuracy.

d. Vehicle throttle control linkage is adjusted so full throttle is obtained and when released throttle is stopped by throttle adjusting screw (throttle leakage adjusting screw).

NOTE

Vehicle throttle control linkage should have a maximum throttle stop, so when fuel pump full throttle is obtained override pressure will not be on throttle shaft.

e. When the fuel pump has been properly calibrated, very little adjustment should be required after installation on the engine except idle, since this setting is dependent on parasitic loads. Fine adjustment of governor settings and fuel manifold pressure is permissible within the specified limits if justified by engine performance tests.

3-203. Idle Speed.

a. After fuel pump installation, engine must be operated a sufficient period of time to purge all air from the fuel system and to bring engine up to operating temperature (at least 165°F (74°C) oil temperature.

NOTE

Idle speed adjustment should never be made on a cold engine.

b. Remove pipe plug from spring pack cover.

c. The idle adjusting screw is held in position by a spring clip. Turn screw in to increase, or out to decrease the speed. Use ST-984 to adjust idle speed while engine is running. This tool seals the spring pack housing, permitting an accurate adjustment.

Idle Speed rpm 600 ± 20

d. Replace pipe plug when idle speed is correct.

3-204. High Speed.

a. A means of loading the engine must be used to perform this check. The tachometer and fuel manifold pressure gage must be of high accuracy. The engine fuel system must be purged of all air and at operating temperature.

b. The preferred method of checking governor setting is to load the engine on an engine or chassis dynamometer.

c. Maximum engine speed is adjusted by adding or removing shims under the high-speed governor spring. Normally, this adjustment is made on the fuel pump test stand as the fuel pump is calibrated and does not need to be changed on the engine.

3-205. Cutoff Setting.

a. At full throttle, increase load until the speed is pulled down to at least 100 rpm below engine rated speed, then decrease the load gradually while observing the fuel manifold pressure gage. (The fuel manifold pressure will increase with decreasing load until the governor begins restricting fuel and then the pressure will begin decreasing with decreasing load.)

b. Continue decreasing load until fuel manifold pressure reaches its peak and decreased 1-2 psi. This is the so-called "governor goes dead," "governor break," or "governor cutoff" point. This speed is between 30-50 rpm higher than engine rated speed to assure that governor is not restricting before rated speed. For example: On a 2100-rpm engine this speed should be 2130-2150 rpm.

c. If the governor cutoff point is higher or lower than specifications, shims should be removed or added from behind governor high-speed spring accordingly.

d. Recheck the governor cutoff point adjustment.

3-206. Engine Hi-Idle or Maximum No-Load Speed.

a. Operate engine to purge all air from fuel system and bring up to operating temperature.

b. With transmission in neutral or the clutch disengaged, open throttle and hold fully open. Note the maximum engine speed. This speed will be 10-12 percent greater than the "governor cutoff" speed, depending upon engine parasitic loads (fans, pumps, etc.).

c. This check should not be used to check or make governor speed adjustments. This check is of secondary importance and must be considered as such unless the no-load speed is significantly greater than specifications, in which case the governor assembly should be examined for malfunction or improper parts.

3-207. **Checking and Adjusting Fuel Manifold Pressure.** Listed below are three methods of checking fuel manifold pressure. The engine must be at operating temperature and fuel system purged of all air.

a. The preferred method of checking engine manifold pressure is to load engine on an engine or chassis dynamometer as follows.

(1) Check governor cutoff as detailed previously.

(2) At full throttle, increase load until engine is pulled down to rated speed (accurate tachometer must be used). Read fuel manifold pressure. If engine fuel manifold pressure is below minimum or above maximum specifications, make the following adjustments.

(a) *To Raise Pressure.*

1. Screw out maximum throttle opening stop screw and utilize throttle restriction that may present.

CAUTION

Do not unscrew the screw beyond maximum throttle opening point; otherwise, a dead throttle travel may occur.

2. Screw out the fuel adjusting screw in throttle shaft. Drive steel ball into end of shaft after adjusting.

(b) *To Decrease Pressure.*

1. Screw in adjusting screw in throttle shaft. Drive steel ball into end of shaft after adjusting.

CAUTION

Under no circumstances should engine manifold pressure be set above maximum specifications. Doing so will void engine warranty.

2. It should not be necessary to adjust fuel manifold pressure on a newly calibrated pump more than ± 2 psi (0.14 kg/sq cm). If adjustments greater than this are required, fuel pump test, injector test stand, or engine problems may exist.

b. The next best method of checking maximum engine fuel manifold pressure while accelerating at full throttle when going up through the transmission ratios. With proper gage snubbing, this method can be relatively accurate, especially if a heavy load is being pulled and engine acceleration in the higher gears is slow.

c. The least preferred method of checking maximum engine fuel manifold pressure is the so-called "snap" pressure check method.

(1) The "snap" method is not as reliable as methods 1 and 2 because the pressure reading is of very short duration. Gage inertia and/or the degree of throttle manipulation also reduces the reliability of snap pressure readings.

(2) To take snap pressure readings, attach a suitable pressure gage at the shutdown valve in the usual manner.

(3) Disconnect the vehicle throttle control linkage at the throttle lever. Move lever clockwise against stop.

(4) Start engine and run engine speed up to 200-300 rpm above idle by opening throttle slightly, then snap throttle to fully-open position and permit engine to accelerate to maximum speed while observing pressure gage. Note momentary maximum pressure. Take this reading several times.

NOTE

Due to its poor reliability and inherent inaccuracy, this check should not be used to gage fuel pump test stand calibration accuracy.

On turbocharged engines having aneroid, it is necessary that air connection to the AFC be blocked or removed when making snap pressure checks.

3-208. Checking and Adjusting Engine Fuel Rate. Engine fuel rate (fuel consumption) in lbs/per hour is measured by using a suitable flow rater.

a. The fuel rate specified on fuel pump calibration specifications is at full throttle and rated speed.

b. An engine dynamometer, chassis dynamometer or other controlled means of loading engine must be used. Accurate fuel manifold pressure and speed readings must also be taken.

c. To check engine fuel rate, load engine at full throttle until engine speed is pulled down to and kept at rated speed (check governor cutoff speed as previously described while loading engine). Note fuel manifold pressure at rated speed. Hold engine speed and load stable at rated speed long enough for the flowmeter float to stabilize. Take the fuel rate reading.

3-209. Throttle Leakage.

a. The purpose of throttle leakage is to keep fuel lines or supply drillings and injector drillings full of fuel during closed throttle engine motoring.

b. Throttle leakage prevents engine response hesitation when throttle is opened after down grade closed throttle motoring and prevents the engine from stalling when it decelerates to idle.

(1) Excessive throttle leakage will cause engine to decelerate too slowly.

(2) Insufficient throttle leakage will cause engine response hesitation after closed throttle motoring and stalling after decelerating to idle.

NOTE

If throttle leakage is adjusted correctly on fuel pump test stand, adjustment after fuel pump installation on engine is not required.

c. If throttle leakage adjustment on engine is required, it should be performed in the following manner.

d. Engine must be operated long enough to purge all air from fuel system and at operating temperature.

CAUTION

Never check engine deceleration or adjust throttle leakage on a cold engine. Engine will decelerate faster when cold due to greater friction drag.

e. Vehicle throttle linkage must be adjusted so pump throttle just contacts the rear throttle stop screw when throttle is closed.

f. A fuel manifold pressure gage must not be in use.

g. A stop watch or other suitable timer and tachometer must be used to perform the following check.

h. With transmission in neutral or clutch disengaged, open throttle fully and let engine run at hi-idle (maximum no-load speed).

(1) Release or move throttle to closed position quickly and start stop watch simultaneously.

(2) Stop the stop watch when engine reaches 1000 rpm and note deceleration time. Repeat several times.

(3) If engine begins to stall (idle governor does not catch engine) after decelerating from hi-idle, throttle leakage must be increased.

(a) Note position of throttle leakage adjusting screw, rear screw on AFC.

(b) Turn screw in while checking engine deceleration as described previously until deceleration time is increased 1-2 seconds. Lock the screw in this position and recheck idle speed. Readjust as necessary.

i. If engine decelerates two slowly, it may be necessary to decrease throttle leakage. Before decreasing throttle leakage, be sure it is required by first checking deceleration time when shutdown valve is closed (engine is shut down) while running at hi-idle. If deceleration is not faster by this method, throttle leakage is not the problem. If deceleration is significantly faster by this method, throttle leakage should be reduced.

(1) Note position of throttle leakage adjusting screw.

(2) Back screw out while checking engine deceleration as described previously until engine tends to stall after decelerating from hi-idle. Turn screw in until deceleration time is increased 1-2 seconds. Lock screw in position and check idle speed. Adjust idle speed as required.

3-210. Engine Power.

a. Engine power cannot be gaged accurately in any way except on an engine dynamometer. Any other method of gaging engine power requires the use of assumptions, feel, opinions regarding accessory drive train power losses, and load-measuring equipment accuracy.

b. Fuel pump adjustments should not be made based on estimated power arrived at by this means unless full performance data (fuel manifold pressure, fuel rate, speed settings, smoke, coolant, temperature, combustion smoothness, exhaust restriction, fuel quality, air intake restriction, crankcase oil level and engine power derate factors) also indicates the adjustments are justified. Under no circumstances should these specifications be exceeded.

NOTE

As in all fuel systems and engine performance checks, accurate instruments must be used.

c. Engine rated power (maximum power at engine rated speed) should be checked in the same way as "checking and adjusting engine fuel manifold pressure" and "checking and adjusting engine fuel rate," as previously described.

d. Check governor cutoff setting to assure this is not influencing rated power.

3-211. Fuel Filter Restriction.

a. Fuel filter restriction can be checked using a suitable vacuum gage.

b. Connect gage using a suitable adapter.

c. If restriction reads 8-inch vacuum while engine is running at full speed and load, filter must be changed or other sources of restriction remedied. A suitable sight glass gage will show air bubbles with air entrainment and possible gasket or other leaks.

d. If air bubbles are persistent, check the float valve assembly in the float tank. The gear pump may be pumping more fuel than the float valve will allow to pass into the float tank. A new interchangeable float valve is available with sufficient capacity to meet this requirement.

3-212. Seal Fuel Pump.

a. To prevent unauthorized adjustments of the fuel pump after final adjustments are made, seal the spring pack housing lower capscrews and the rear throttle screw or throttle cover and spring pack cover plug (fig. 3-233).

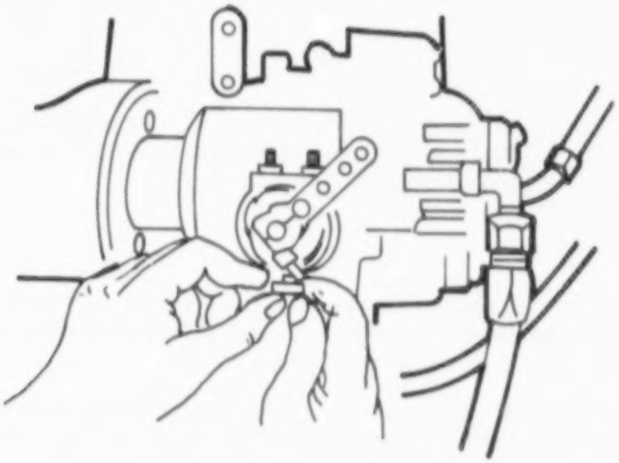


Figure 3-233. Sealing Fuel Pump.

b. Spring Pack Housing Seal.

(1) Install bottom capscrew with drilled hole in head. Install plug with drilled hole into spring pack housing.

(2) Insert seal wire through capscrew and plug.

(3) Twist the seal wire ends together until connection is secure and wire is tight.

(4) Bend twisted wire into seal and press on top half of seal.

c. Drive Cover Seal.

(1) Use a longer wire to reach a lower capscrew on the drive cover.

(2) Wire the spring pack as in Step b except before sealing, run wire through capscrew hole in lower drive cover.

(3) Twist wire and seal as in Step *b*.

NOTE

When using a spring pack cover having a plug, saw off plug flush with cover.

d. Remove standard snap ring securing throttle shaft cover and replace with snap ring, Part No. 214761. To seal AFC cover plate, front cover and spring pack cover, install seal wire and seal as shown in figure 3-234.

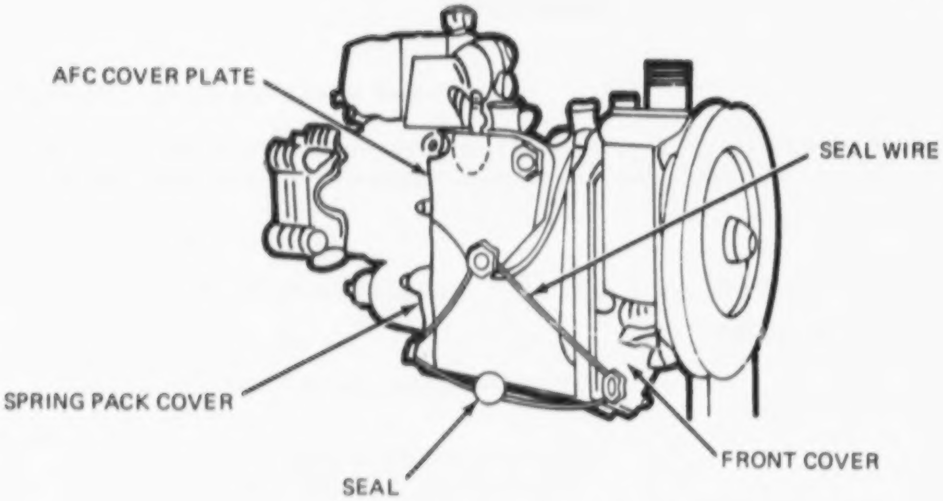


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Figure 3-234. Sealing AFC Fuel Pump.

3-213. Throttle Cover Plate Installation. After fuel pump settings are completed on AFC pumps, install the throttle cover plate.

a. If plate was removed by grinding off heads of drive screws, drill two holes with a No. 44 (0.086 inch (2.18 mm) drill, 0.235 inch (5.97 mm) deep in two points on opposite sides of the cover plate and into pump housing.

b. Use an etching tool or steel stamp and imprint date of repair on back side of throttle cover plate for further reference.

c. Secure cover plate with two S-2286 Drive Screws.

3-214. Fuel Pump Seals. All fuel pumps will be sealed at the factory. The lead seal marking relates to a manufacturing control system. All warranty claims sent to the factory must have the seal attached. After completing any fuel pump repair, the pump must be resealed.

APPENDIX A

REFERENCES

A-1. Publication Indexes and General References.

Indexes should be consulted frequently for latest changes or revisions of references given in this appendix and for new publications relating to material covered in this publication.

a. Military Publication Indexes.

Index of Administrative Publications	DA Pam 310-1
Index of Blank Forms	DA Pam 310-2
Index of Doctrinal, Training, and Organizational Publications	DA Pam 310-3
Index of Technical Manuals, Technical Bulletins, Supply Manuals (Types 7, 8, and 9), Supply Bulletins, and Lubrication Orders	DA Pam 310-4
Index of Graphic Training Aids and Devices	DA Pam 310-5

b. General References.

Authorized Abbreviations and Brevity Codes	AR 310-50
Techniques of Military Instruction	FM 21-6
Military Symbols	FM 21-30

A-2. Forms.

Refer to TM 38-750, The Army Maintenance Management System (TAMMS), for instructions on the use of maintenance forms pertaining to the material.

A-3. Other Publications.

The following publications contain information pertinent to the major item material and associated equipment.

a. Vehicle.

Lubrication Order, Truck Tractor, M915, M916 and M920	LO 9-2320-273-12
Lubrication Order, Dump Truck, M917	LO 5-3805-274-12
Lubrication Order, Bituminous Distributor, M918	LO 5-3895-224-12
Lubrication Order, Concrete Mobile, M919	LO 5-3895-372-12

Operator's Manual	TM 9-2320-273-10
Organizational Maintenance	TM 9-2320-273-20
Organizational Maintenance Repair Parts and Special Tools List	TM 9-2320-273-20P
Direct and General Support Repair Parts and Special Tools List	TM 9-2320-273-34P

b. *Camouflage.*

Camouflage	FM 5-20

c. *Decontamination.*

Chemical, Biological, and Radiological (CBR) Decontamination	TM 3-220
Chemical, Biological, Radiological, and Nuclear Defense	FM 21-40

d. *General.*

Basic Cold Weather Manual	FM 31-70
Cooling Systems: Tactical Vehicles	TM 750-254
Manual for Wheeled Vehicle Driver	FM 21-305
Driver Selection and Training (Wheeled Vehicles)	FM 55-30
Northern Operations	FM 31-71
Operation and Maintenance of Ordnance Material in Cold Weather (0° to -65°F)	FM 9-207
Principles of Automotive Vehicles	TM 9-8000
Prevention of Motor Vehicle Accidents	AR 385-55
Procedures for Destruction of Tank Automotive Equipment to Prevent Enemy Use	TM 750-244-6

e. *Maintenance and Repair.*

Description, Use, Bonding Techniques, and Properties of Adhesives	TB ORD 1032
Inspection, Care, and Maintenance of Antifriction Bearings	TM 9-214
Materials Used for Cleaning, Preserving, Abrading, and Cementing Ordnance Material and Related Materials Including Chemicals	TM 9-247

Metal Body Repair and Related Operations	FM 43-2
Operation and Organizational, Field and Depot Maintenance: Storage Batteries, Lead-Acid Type	TM 9-6140-200-12
Painting Instructions for Field Use	TM 43-0139
Use of Antifreeze Solutions and Cleaning Compounds in Engine Cooling System	TM 43-0139
Use of Antifreeze Solutions and Cleaning Compounds in Engine Cooling System	TB 750-651
Welding Theory and Application	TM 9-237

f. Administrative Storage.

Administrative Storage of Equipment	TM 740-90-1

APPENDIX B

REPAIR PARTS AND SPECIAL TOOLS LISTS

SECTION I. INTRODUCTION

1. Scope.

This manual lists and authorizes spares and repair parts; special tools; special Test, Measurement, and Diagnostic Equipment (TMDE); and other special support equipment required for performance of organizational, direct support, and general support maintenance of the NTC-400 Cummins Diesel Engine. It authorizes the requisitioning, issue, and disposition of spares, repair parts and special tools as indicated by the Source, Maintenance and Recoverability (SMR) codes.

2. General.

This Repair Parts and Special Tools List is divided into the following sections:

a. Section II. Repair Parts List. A list of spares and repair parts authorized by this RPSTL for use in the performance of maintenance. The list also includes parts which must be removed for replacement of the authorized parts. Parts lists are composed of functional groups in ascending alphanumeric sequence, with the parts in each group listed in ascending figure and item number sequence. Bulk materials are listed in NSN sequence.

b. Section III. Special Tools List. A list of special tools, special TMDE, and other special support equipment authorized by this RPSTL for the performance of maintenance.

c. Section IV. National Stock Number and Part Number Index. A list, in National Item Identification Number (NIIN) sequence, of all National Stock Numbers (NSN) appearing in the listings, followed by a list in alphanumeric sequence of all part numbers appearing in the listings. National stock numbers and part numbers are cross-referenced to each illustration figure and item number appearance.

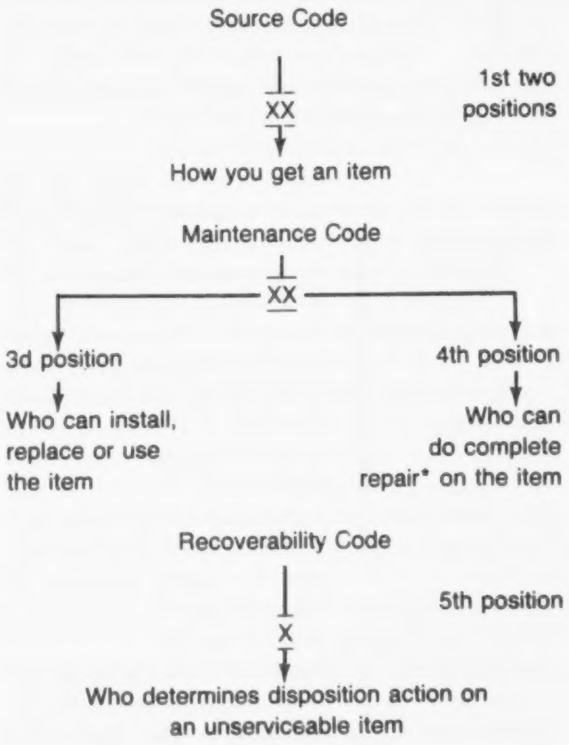
3. Explanation of Columns.

a. Illustration (Column (1)). This column is divided as follows:

(1) ((a) FIG NO.) Figure Number. Indicates the figure number illustrating an exploded view of a functional group.

(2) ((b) ITEM NO.). Indicates the number used to identify items called out in the illustration.

b. SMR CODE (Column (2)). The Source, Maintenance, and Recoverability (SMR) code is a 5-position code containing supply/requisitioning information, maintenance category authorization criteria, and disposition instructions, as shown in the following breakout:


Source Code
XX
1st two positions
How you get an item
Maintenance Code
XX
3d position
Who can install, replace or use the item
4th position
Who can do complete repair* on the item
Recoverability Code
X
5th position
Who determines disposition action on an unserviceable item

*Complete Repair: Maintenance capacity, capability, and authority to perform all the corrective maintenance tasks of the "Repair" function in a use/user environment in order to restore serviceability to a failed item.

(1) Source Code. The source code tells you how you get an item needed for maintenance, repair, or overhaul of an end item/equipment. Source codes are always the first two positions of the SMR code. Explanations of source codes follow:

Code	Explanation
PA PB PC PD PE PF PG	Stocked items; use the applicable NSN to request/requisition items with these source codes. They are authorized to the category indicated by the code entered in the 3d position of the SMR code.
KD KF KB	Items with these codes are not to be requested/requisitioned individually. They are part of a kit which is authorized to the maintenance category indicated in the 3d position of the SMR code. The complete kit must be requisitioned and applied.
MO-(Made at Org Category) MF-(Made at DS Category) MH-(Made at GS Category) MD-(Made at Depot)	Items with these codes are not to be requested/requisitioned individually. They must be made from bulk material which is identified by NSN in the Description column and listed in the Bulk Material group in the repair parts list in this manual. If the item is authorized to you by the 3d position code of the SMR code, but the source code indicates it is made at a higher category, order the item from the higher category of maintenance.
AO-(Assembled by Org Category) AF-(Assembled by DS Category) AH-(Assembled by GS Category) AD-(Assembled by Depot)	Items with these codes are not to be requested/requisitioned individually. The parts that make up the assembled item must be requisitioned or fabricated and assembled at the category of maintenance indicated by the source code. If the 3d position code of the SMR code authorizes you to replace the item, but the source code indicates the item is assembled at a higher category, order the item from the higher category of maintenance.
XA	Do not requisition an "XA"-coded item. Order its next higher assembly. (Also, refer to the NOTE below.)
XB	If an "XB" item is not available from salvage, order it using the FSCM and part number given.
XC	Installation drawing, diagram, instruction sheet, field service drawing, that is identified by manufacturer's part number. Not applicable.
XD	Item is not stocked. Order an "XD"-coded item through normal supply channels using the FSCM and part number given, if no NSN is available.

NOTE: Cannibalization or controlled exchange, when authorized, may be used as a source of supply for items with the above source codes, except for those source coded "XA".

(2) Maintenance Code. Maintenance codes tell you the category(s) of maintenance authorized to USE and REPAIR support items. The maintenance codes are entered in the third and fourth positions of the SMR Code as follows:

(a) The maintenance code entered in the third position tells you the lowest maintenance category authorized to remove, replace, and use an item. The maintenance code entered in the third position will indicate authorization to one of the following categories of maintenance.

Code	Application/Explanation
C	-Crew or operator maintenance done within organization maintenance.
O	-Organizational category can remove, replace, and use the item.
F	-Direct support category can remove, replace, and use the item.
H	-General support category can remove, replace, and use the item.
L	-Specialized repair activity can remove, replace, and use the item.
D	-Depot category can remove, replace, and use the item.

(b) The maintenance code entered in the fourth position tells you whether or not the item is to be repaired and identifies the lowest maintenance category with the capability to do complete repair (i.e., perform all authorized repair functions). (NOTE: Some limited repair may be done on the item at a lower category of maintenance, if authorized by the Maintenance Allocation Chart (MAC) and SMR codes.) This position will contain one of the following maintenance codes.

Code	Application/Explanation
O	-Organizational is the lowest category that can do complete repair of the item.
F	-Direct support is the lowest category that can do complete repair of the item.
H	-General support is the lowest category that can do complete repair of the item.
L	-Specialized repair activity is the lowest category that can do complete repair of the item.
D	-Depot is the lowest category that can do complete repair of the item.
Z	-Nonreparable. No repair is authorized.
B	-No repair is authorized. (No parts or special tools are authorized for the maintenance of a "B" coded item.) However, the item may be reconditioned by adjusting, lubricating, etc., at the user level.

(3) Recoverability Code. Recoverability codes are assigned to items to indicate the disposition action on unserviceable items. The recoverability code is entered in the fifth position of the SMR code as follows:

Recoverability Codes	Definition
Z	-Nonreparable item. When unserviceable, condemn and dispose of the item at the category of maintenance shown in 3d position of SMR code.
O	-Reparable item. When uneconomically reparable, condemn and dispose of the item at organizational category.
F	-Reparable item. When uneconomically reparable, condemn and dispose of the item at the direct support category.
H	-Reparable item. When uneconomically reparable, condemn and dispose of the item at the general support category.
D	-Reparable item. When beyond lower category repair capability, return to depot. Condemnation and disposal of item not authorized below depot category.
L	-Reparable item. Condemnation and disposal not authorized below specialized repair activity.
A	-Item requires special handling or condemnation procedures because of specific reasons (i.e., precious metal content, high dollar value, critical material or hazardous material). Refer to appropriate manuals/directives for specific instructions.

c. NATIONAL STOCK NUMBER (Column (3)). Lists the National Stock Number (NSN) assigned to the item. Use the NSN for requests/requisitions.

d. FSCM (Column (4)). The Federal Supply Code for Manufacturer (FSCM) is a 5-digit numeric code which is used to identify the manufacturer, distributor, or Government agency, etc., that supplies the item.

e. PART NUMBER (Column (5)). Indicates the primary number used by the manufacturer (individual, company, firm, corporation, or Government activity), which controls the design and characteristic of the item by means of its engineering drawings, specifications standards, and inspection requirements to identify an item or range of items.

NOTE: When you use an NSN to requisition an item, the item you receive may have a different part number from the part ordered, but go ahead and use or furnish it as the replacement part.

f. DESCRIPTION (Column (6)). This column includes the following information:

(1) The Federal item name and, when required, a minimum description to identify the item.

(2) The physical security classification. Not applicable.

(3) Items that are included in kits and sets are listed below the name of the kit or set.

(4) Spare/repair parts that make up an assembled item are listed immediately following the assembled item line entry. If the first item of a figure is indented, the assembly appears as the last item in the previous figure.

(5) NSN's for bulk materials are referenced in the description column in the line item entry for the item to be manufactured/fabricated.

(6) When the part to be used differs between serial numbers of the same model, the effective serial numbers are shown as the last line of the description.

(7) The USABLE ON CODE. Not applicable.

(8) In the Special Tools List section, the Basis Of Issue (BOI) appears as the last line(s) in the entry for each special tool, special TMDE, and other special support equipment. When density of equipments supported exceeds density spread indicated in the basis of issue, the total authorization is increased proportionately.

g. U/M (Column (7)). The Unit of Measure (U/M) indicates the measure (e.g., foot, gallon, pound) or count (e.g., each, dozen, gross) of a listed item. A two-character alpha code (e.g., FT, GL, LB, EA, DZ, GR) appears in this column to indicate the measure or count. If the U/M code appearing in this column differs from the Unit of Issue (U/I) code listed in the Army Master Data File (AMDF), request the lowest U/I that will satisfy your needs.

h. QTY INC IN UNIT (Column (8)). The Quantity Incorporated in Unit (QTY INC IN UNIT) indicates the quantity of the item used in the breakout shown on the illustration figure, which is prepared for a functional group, subfunctional group, or an assembly. A "V" appearing in this column in lieu of a quantity indicates that no specific quantity is applicable (e.g., shims, spacers).

4. SPECIAL INFORMATION.

a. Bulk materials required to manufacture items are listed in the Bulk Material Group of this manual. NSN's for bulk materials are also referenced in the description column of the line item entry for the item to be manufactured/fabricated. Detailed manufacturing instructions for items source coded to be manufactured or fabricated are found in the appropriate appendices of this manual.

b. Detailed assembly instructions for items source coded to be assembled from component spare/repair parts are found in the appropriate appendices of this manual. Items that make up the assembly are listed immediately following the assembled item entry.

c. Line item entries for repair kits and sets appear as the last entries in the repair parts listing for the figure in which their parts are listed as repair parts.

d. Items which have the word BULK in the figure number column will have an index number shown in the item number column. This index number is furnished for use as a cross-reference between the National Stock Number/Part Number Index and the Bulk Material List in Section II.

5. How to Locate Repair Parts.

a. When National Stock Number or Part Number is Not Known:

(1) First. Using the table of contents, determine the functional group to which the item belongs. This is necessary since figures are prepared for functional groups, and listings are divided into the same groups.

(2) Second. Find the figure covering the functional group to which the item belongs.

(3) Third. Identify the item on the figure and note the item number of the item.

(4) Fourth. Refer to the Repair Parts List for the figure to find the line item entry for the item number noted on the figure.

b. When National Stock Number or Part Number is Known:

(1) First. Using the Index of National Stock Numbers and Part Numbers, find the pertinent National stock number or part number. The NSN index is in National Item Identification Number (NIIN)* sequence. The part numbers in the Part Number index are listed in ascending alphanumeric sequence. Both indexes cross-reference you to the illustration figure and item number of the item you are looking for.

*The NIIN consists of the last 9 digits of the NSN

NSN
(i.e., 5305-01-674-1467).
NIIN

(2) Second. After finding the figure and item number, verify that the item is the one you're looking for, then locate the item number in the repair parts list for the figure.

6. Abbreviations.

For standard abbreviations see MIL-STD-12D, Military Standard Abbreviations For Use On Drawing, Specifications, Standards And in Technical Documents.

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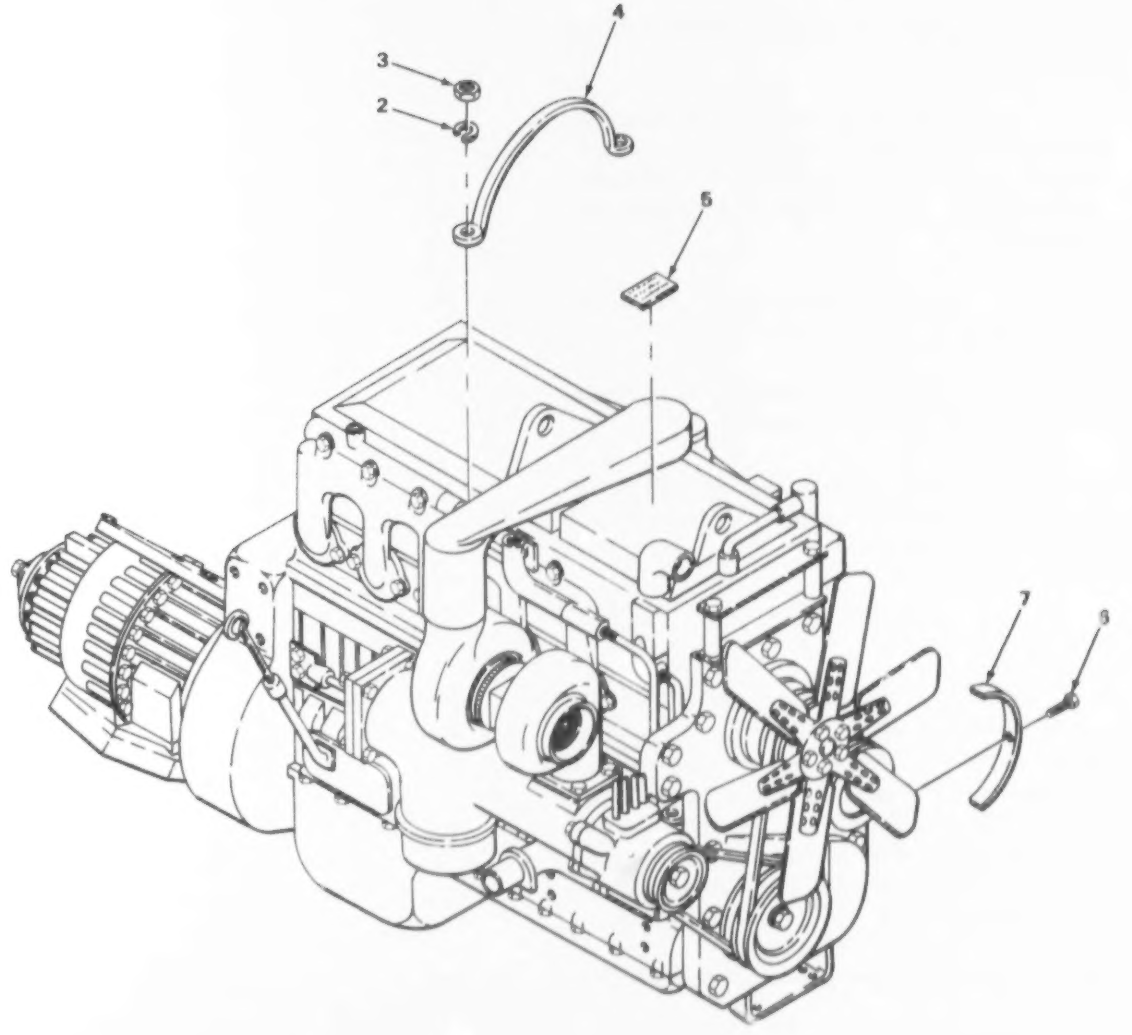

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FIGURE 1. ENGINE, LIFTING BRACKETS AND DATA PLATES.

REPAIR PARTS LIST

(1) ILLUSTRATION		(2)	(3)	(4)	(5)	(6)	(7)	(8)
(a) FIG. NO.	(b) ITEM NO.	SMR CODE	NATIONAL STOCK NUMBER	FSCM	PART NUMBER	DESCRIPTION USABLE ON CODE	U/M	QTY INC IN UNIT
						GROUP 01-ENGINE 0100-ENGINE ASSEMBLY		
1	1	PAFHD	2815-01-084-3447	34623	MA87-21005	ENGINE,DIESEL W/ACCESSORIES	EA	1
1	2	PAOZZ	5310-00-584-5272	96906	MS35338-48	.WASHER,LOCK PART OF ATTACHING HARDWARE ROCKER LEVER ASSEMBLY	EA	4
1	3	PAOZZ	5310-01-144-6115	75078	001094	.NUT,HEX PART OF ATTACHING HARDWARE ROCKER LEVER ASSEMBLY	EA	4
1	4	PBOZZ	2815-01-079-3321	15434	3009185	.BRACKET,ENGINE	EA	2
1	5	PAOZZ	7530-01-083-7892	15434	3003480	.LABEL	EA	1
1	6	PAOZZ	5305-00-804-6318	15434	S-2286	.SCREW	EA	5
1	7	PAOZZ	7690-01-094-6720	15434	3015739	.PLATE	EA	1

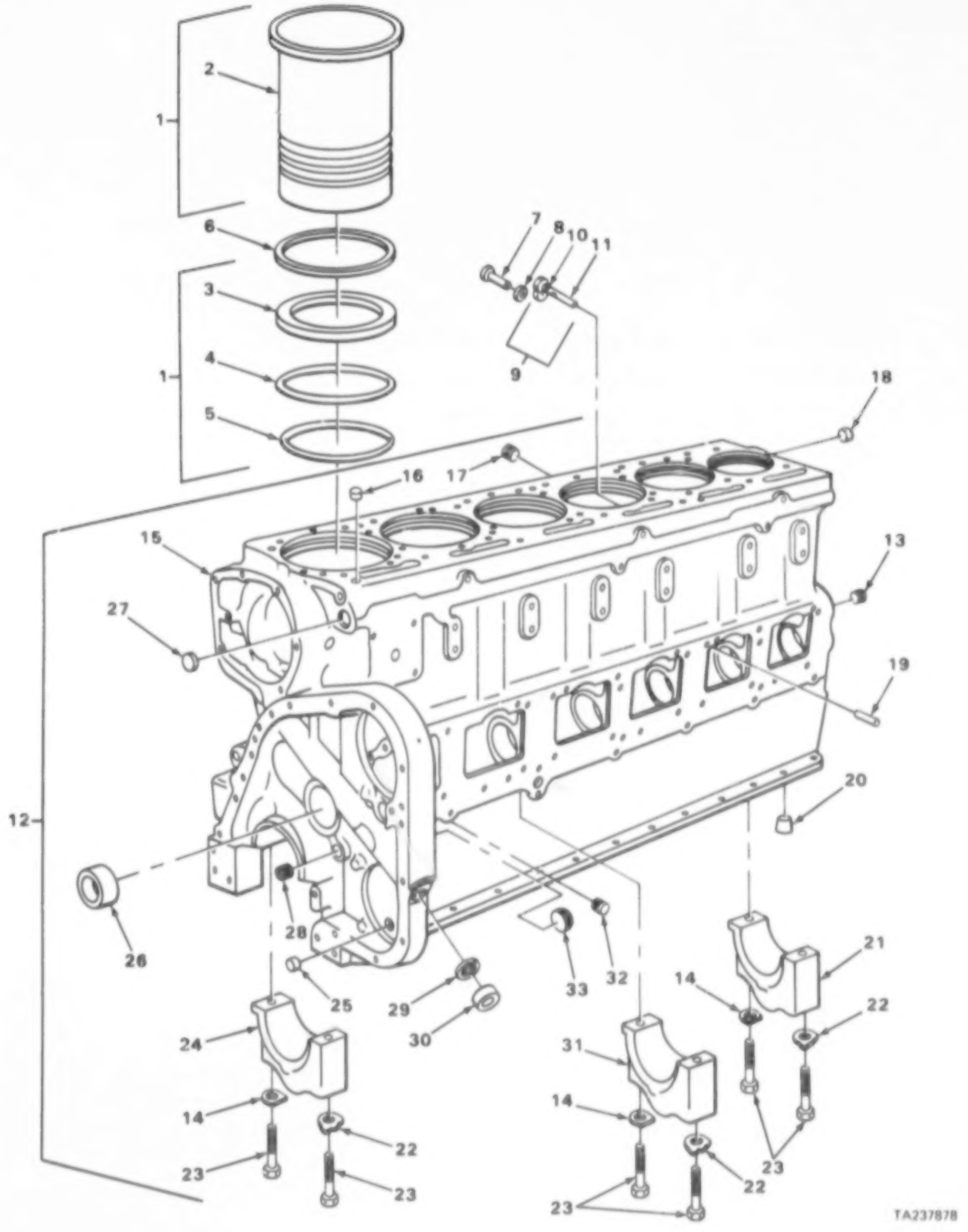
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FIGURE 2. DIESEL ENGINE BLOCK.

(1) ILLUS-TRATION (a) FIG. NO.	(1) ILLUS-TRATION (b) ITEM NO.	(2) SMR CODE	(3) NATIONAL STOCK NUMBER	(4) FSCM	(5) PART NUMBER	(6) DESCRIPTION USABLE ON CODE	(7) U/M	(8) QTY INC IN UNIT
						0101-CRANKCASE, BLOCK, CYLINDER HEAD		
2	1	PAHHH	2815-00-011-7786	15434	AR11317	LINER,CYLINDER,ASSE	EA	6
2	2	XAHZZ		15434	213740	.CYLINDER,SLEEVE	EA	1
2	3	PCHZZ	5330-00-064-4399	15434	215090	.PACKING,PREFORMED	EA	1
2	4	PCHZZ	5330-01-049-0466	15434	3008998	.PACKING,PREFORMED	EA	1
2	5	PCHZZ	5330-00-058-1767	15434	183049	.PACKING,PREFORMED	EA	1
2	6	PAHZZ	5365-00-488-0799	15434	143939	SHIM LINER .008 IN	EA	V
2	6	PAHZZ	5365-01-086-8214	15434	143947	SHIM LINER .020 IN	EA	V
2	6	PAHZZ	5365-00-485-9250	15434	143938	SHIM LINER .007 IN	EA	V
2	6	PAHZZ	5365-00-487-1927	15434	143946	SHIM LINER .009 IN	EA	V
2	6	PAHZZ	5365-01-086-7680	15434	143949	SHIM LINER .062 IN	EA	V
2	6	PAHZZ	5365-01-086-6759	15434	143948	SHIM LINER .031 IN	EA	V
2	7	XDHZZ		15434	3010395	SCREW,SELF-LOCKING	EA	6
2	8	XDHZZ		15434	3017915	WASHER,FLAT	EA	6
2	9	PAHHH	2910-01-085-8096	15434	3014404	NOZZLE,PISTON	EA	6
2	11	XAHZZ		15434	214577	.NOZZLE,PISTON	EA	1
2	12	PAHHH	2815-01-105-8768	15434	3013908	BLOCK,DIESEL ENGINE	EA	1
2	13	PAHZZ	4730-00-924-7886	15434	69901	.PLUG,PIPE CYLINDER BLOCK ASSEMBLY MOUNTED	EA	1
2	14	PAHZZ	5310-00-356-1447	15434	9427	.PLATE,LOCKING	EA	7
2	15	XDHZZ		15434	3013630	.BLOCK,DIESEL ENGINE	EA	1
2	16	PAHZZ	5315-00-281-7610	15434	68445	.PIN,STRAIGHT,HEADLE CYLINDER HEADS	EA	6
2	17	PAHZZ	4730-00-801-8166	15434	S915A	.PLUG,PIPE	EA	1
2	18	XDHZZ		15434	S966E	.PLUG,PIPE	EA	1
2	19	PAHZZ	5315-00-014-1195	15434	68585	.PIN,STRAIGHT,HEADLE MAIN CAPS	EA	6
2	20	PAHZZ	5315-00-532-9388	19207	5329388	.PIN,STRAIGHT,HEADLE REAR MAIN CAPS	EA	2
2	21	PAHZZ	2815-00-484-8360	15434	42647	.CAP,BEARING MAIN NO 7	EA	1
2	22	XDHZZ		15434	3009213	.PLATE,LOCKING	EA	7
2	23	PAHZZ	5306-00-804-2468	15434	105953	.SCREW,CAP,HEXAGON H	EA	14
2	24	PAHZZ	2815-00-484-8359	15434	42645	.CAP,BEARING MAIN NO 1,3 & 5	EA	3

(1) ILLUS-TRATION		(2)	(3)	(4)	(5)	(6)		(7)	(8)
(a) FIG. NO.	(b) ITEM NO.	SMR CODE	NATIONAL STOCK NUMBER	FSCM	PART NUMBER	DESCRIPTION	USABLE ON CODE	U/M	QTY INC IN UNIT
						0101(CONT)			
2	25	PBHZZ	4730-01-128-4598	15434	67622	.PLUG,PIPE..		EA	1
2	26	PAHZZ	3120-01-079-6823	15434	3011951	.BEARING,SLEEVE......................................		EA	7
2	27	XDHZZ		15434	3011952	.PLUG,EXPANSION......................................		EA	1
2	28	PAHZZ	4730-00-042-8988	55883	IPD7H3171	.PLUG,PIPE..		EA	2
2	29	PAHZZ	5310-00-197-5304	15434	66292	.WASHER,FLAT COPPER................................		EA	1
2	30	XDHZZ		15434	210884	.PLUG,PIPE..		EA	1
2	31	PAHZZ	3130-00-408-9041	15434	42646	.CAP,BEARING MAIN NO 2,4 & 6.......................		EA	3
2	32	PAHZZ	4730-00-018-9566	15434	S911B	.PLUG,PIPE..		EA	1
2	33	PAHZZ	4730-00-404-2908	15434	199067	.PLUG,PIPE..		EA	1

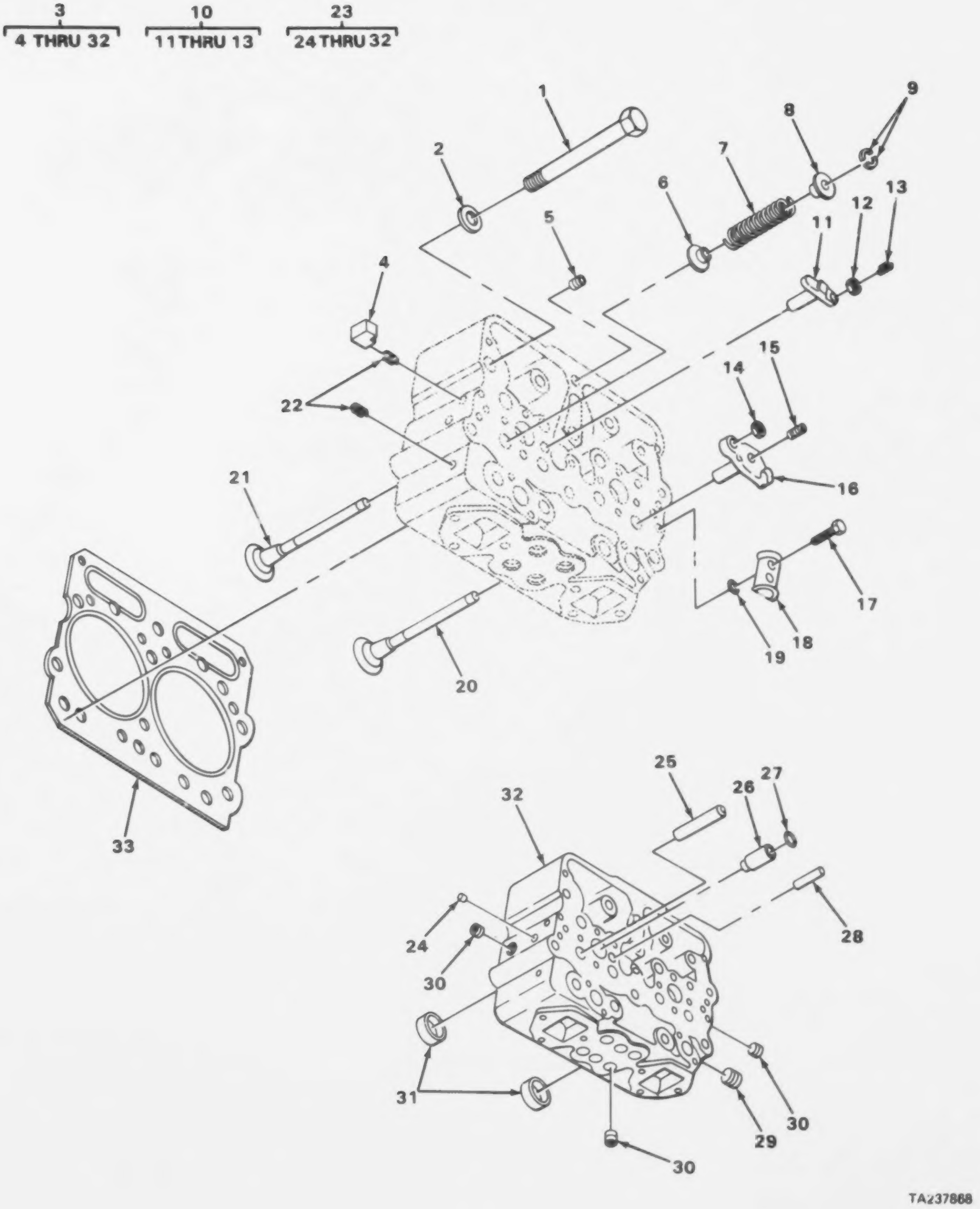
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FIGURE 3. CYLINDER HEAD ASSEMBLY.

(1) ILLUSTRATION		(2)	(3)	(4)	(5)	(6)	(7)	(8)
(a) FIG. NO.	(b) ITEM NO.	SMR CODE	NATIONAL STOCK NUMBER	FSCM	PART NUMBER	DESCRIPTION USABLE ON CODE	U/M	QTY INC IN UNIT
						0101(CONT)		
3	1	XDFZZ		15434	3013623	SCREW,CAP,HEXAGON H	EA	12
3	2	PAFZZ	5310-00-962-5610	15434	69699	WASHER,FLAT	EA	12
3	3	PAFFF	2815-01-085-8282	15434	3008101	HEAD,CYLINDER	EA	3
3	4	PAFZZ	4730-00-444-1710	15434	181213	.ELBOW FUEL LINES	EA	2
3	5	PAFZZ	5365-00-401-2934	15434	S965E	.PLUG,PIPE	EA	2
3	6	PAFZZ	2815-00-632-6239	15434	172034	.GUIDE,VALVE SPRING LOWER,VALVE TO HEAD	EA	8
3	7	PAFZZ	5360-00-009-9270	15434	211999	.SPRING,HELICAL,COMP VALVE,VALVE TO HEAD	EA	8
3	8	PAFZZ	2815-00-933-3009	15434	170296	.GUIDE,VALVE SPRING UPPER,VALVE TO HEAD	EA	8
3	9	PAFZZ	2815-00-994-4434	15434	127554	.COLLET,VALVE VALVE TO HEAD	EA	16
3	10	PAFFF	2815-00-300-0882	15434	3036065	.CROSSHEAD,VALVE INTAKE ONLY	EA	2
3	11	PBFZZ	2815-01-122-4010	15434	3030038	..CROSSHEAD,VALVE	EA	1
3	12	PBFZZ	5310-00-426-3990	15434	203131	..NUT,CROSSHEAD ADJUSTING	EA	2
3	13	PBFZZ	5305-00-062-4378	15434	147389	..SCREW,CROSSHEAD ADJUSTING	EA	1
3	14	PBFZZ	5310-00-426-3390	15434	203131	.NUT,CROSSHEAD ADJUSTING	EA	2
3	15	PBFZZ	5305-00-062-4378	15434	147389	.SCREW,CROSSHEAD ADJUSTING	EA	2
3	16	PBFZZ	2815-01-085-3733	75078	001188	.CROSSHEAD,VALVE EXHAUST	EA	2
3	17	PBFZZ	5305-00-477-6769	15434	70772	.SCREW,MACHINE CROSSOVERS TO HEADS	EA	4
3	18	PBFZZ	2910-00-928-3505	15434	147100	.CROSSOVER,FUEL	EA	2
3	19	PCFZZ	5330-00-143-8485	15434	131026	.PACKING,PREFORMED PART OF KIT P/N 3018762	EA	4
3	20	PAFFF	2815-01-079-3298	15434	3000926	.VALVE,INTAKE	EA	4
3	21	PAFFF	2815-00-962-5623	15434	145701	.VALVE,EXHAUST	EA	4
3	22	PAFZZ	4730-00-018-9566	15434	S911B	.PLUG,PIPE	EA	4
3	23	PAFFF	2815-01-080-0642	15434	3008089	.HEAD,CYLINDER	EA	1
3	24	PBFZZ	5340-01-086-6193	15434	216524	..PLUG,EXPANSION	EA	2
3	25	PAFZZ	2815-01-085-2618	15434	3006456	..GUIDE,VALVE STEM	EA	8
3	26	PAFZZ	2815-00-085-7442	15434	147056	..SLEEVE,INJECTOR	EA	2
3	27	PCFZZ	5330-01-072-4436	15434	3007759	..PACKING,PREFORMED	EA	2
3	28	PAFZZ	5315-00-866-5015	15434	123558	..PIN,STRAIGHT,HEADLE	EA	4
3	29	PBFZZ	5340-01-087-0682	15434	213394	..PLUG,EXPANSION	EA	1

(1) ILLUS-TRATION (a) FIG. NO.	(1) ILLUS-TRATION (b) ITEM NO.	(2) SMR CODE	(3) NATIONAL STOCK NUMBER	(4) FSCM	(5) PART NUMBER	(6) DESCRIPTION USABLE ON CODE	(7) U/M	(8) QTY INC IN UNIT
						0101(CONT)		
3	30	PBFZZ	5340-01-087-0681	15434	213395	..PLUG,EXPANSION.................	EA	6
3	31	PAFZZ	2815-00-085-7434	15434	127930	..INSERT,VALVE SEAT.................................	EA	8
3	32	XAFZZ		15434	3007716	..HEAD,CYLINDER......................................	EA	1
3	33	PAFZZ	5330-01-080-5021	15434	3036126	GASKET CYLINDER HEAD MOUNTING TO CYLINDER BLOCK PART OF KIT P/N 3801350..............................	EA	3

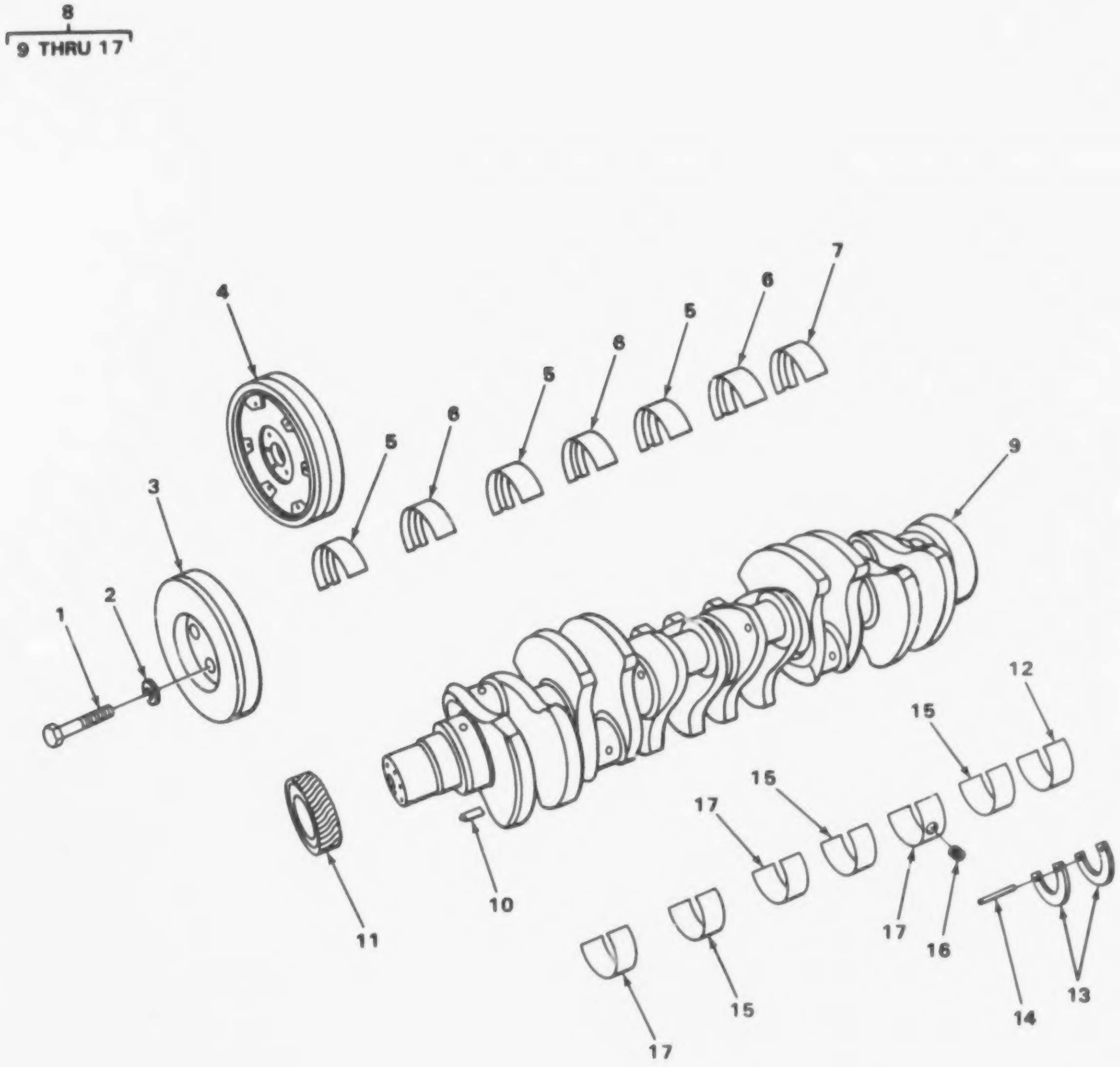
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FIGURE 4. CRANKSHAFT ASSEMBLY.

(1) ILLUS-TRATION (a) FIG. NO.	(1) ILLUS-TRATION (b) ITEM NO.	(2) SMR CODE	(3) NATIONAL STOCK NUMBER	(4) FSCM	(5) PART NUMBER	(6) DESCRIPTION USABLE ON CODE	(7) U/M	(8) QTY INC IN UNIT
						0102-CRANKSHAFT		
4	1	PAFZZ	5305-00-795-9336	15434	204165	SCREW,CAP,HEXAGON H CRANKSHAFT PULLEY AND DAMPER MOUNTING..........	EA	6
4	2	PAFZZ	5310-00-081-8500	15434	127316	WASHER,FLAT PULLEY AND DAMPER MOUNTING............	EA	6
4	3	PAFZZ	6620-01-079-1632	15434	217323	DAMPER,VIBRATION CRANKSHAFT TO CYLINDER BLOCK......	EA	1
4	4	PAFZZ	3020-01-077-4411	15434	211918	PULLEY,GROOVE ALTERNATOR DRIVE....................	EA	1
4	5	PAHZZ	3120-00-005-5883	15434	195190	BEARING,SLEEVE PART OF KIT P/N AR07240............	EA	3
4	6	PAHZZ	3120-00-007-2901	15434	195210	BEARING,SLEEVE PART OF KIT P/N AR07240............	EA	3
4	7	PAHZZ	3120-00-005-0601	15434	187670	BEARING,SLEEVE PART OF KIT P/N AR07240............	EA	1
4	8	XDHDD		15434	3004165	CRANKSHAFT ASSEMBLY................................	EA	1
4	9	PAHDD	2815-01-083-3157	15434	3000140	.CRANKSHAFT,ENGINE................................	EA	1
4	10	PAHZZ	5315-01-079-6740	15434	210179	.KEY,MACHINE CRANKSHAFT GEAR......................	EA	1
4	11	PAHZZ	3020-01-077-2229	15434	215965	.GEAR,HELICAL CRANKSHAFT..........................	EA	1
4	12	PAHZZ	3120-00-005-5882	15434	187680	BEARING,SLEEVE PART OF KIT P/N AR07240............	EA	1
4	13	PAHZZ	3120-00-936-8209	15434	157280	RING,THRUST PART OF KIT P/N AR07240...............	EA	4
4	14	PAHZZ	5315-01-058-4551	15434	202903	PIN,THRUST RING....................................	EA	2
4	15	PAHZZ	3120-00-005-0602	15434	195220	BEARING,SLEEVE PART OF KIT P/N AR07240............	EA	3
4	16	PAHZZ	5365-00-428-6201	15434	60575	RING,MAIN BEARING.................................	EA	7
4	17	PAHZZ	3120-00-005-5884	15434	195200	BEARING,SLEEVE LOWER PART OF KIT P/N AR07240.......	EA	3
4		PAHZZ	3120-01-088-5821	15434	AR07240	BEARING SET CRANKSHAFT............................	EA	1
4	5					BEARING,SLEEVE....................................	EA	3
4	6					BEARING,SLEEVE....................................	EA	3
4	7					BEARING,SLEEVE....................................	EA	1
4	12					BEARING,SLEEVE....................................	EA	1
4	13					RING,THRUST.......................................	EA	4
4	15					BEARING,SLEEVE....................................	EA	3
4	17					BEARING,SLEEVE....................................	EA	3

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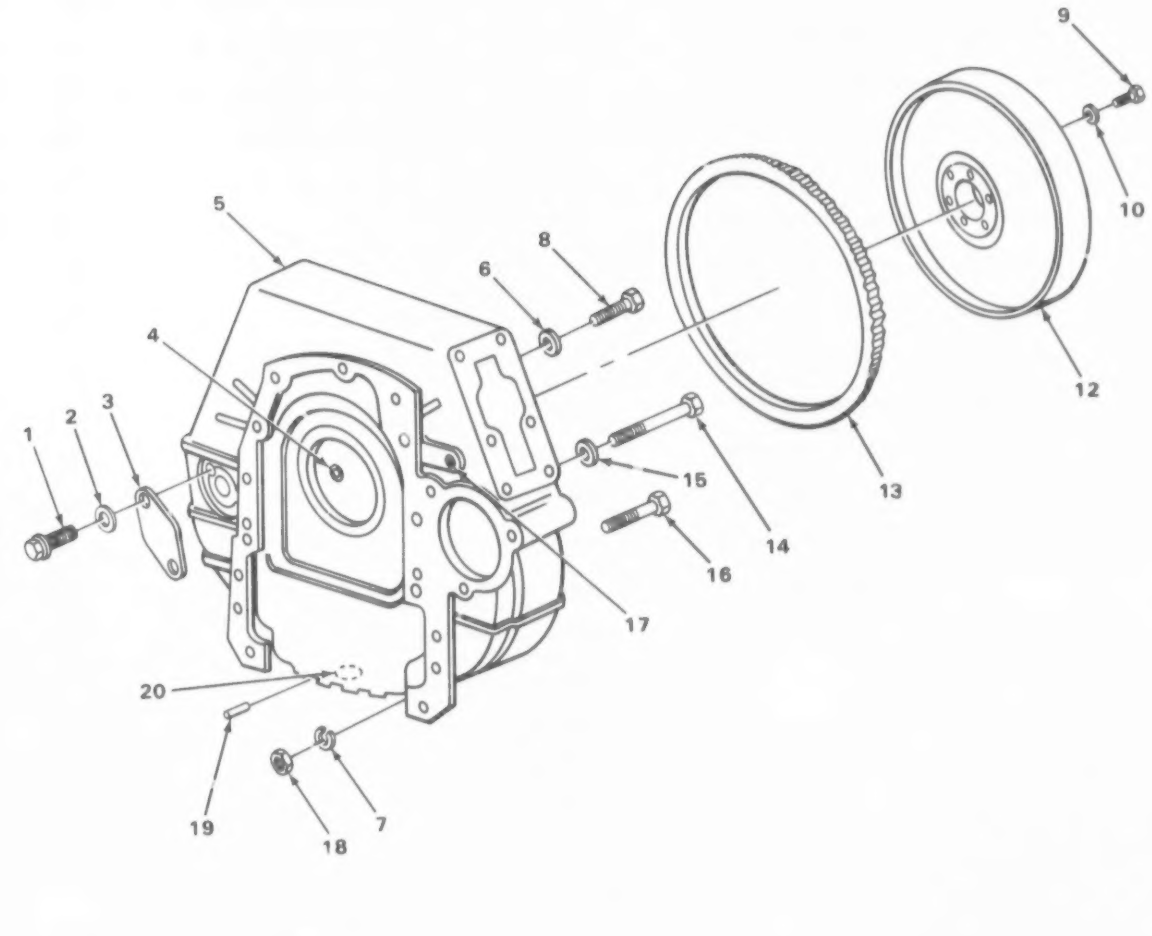
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FIGURE 5. FLYWHEEL, RING GEAR, AND HOUSING ASSEMBLY.

(1) ILLUSTRATION		(2)	(3)	(4)	(5)	(6)	(7)	(8)
(a) FIG. NO.	(b) ITEM NO.	SMR CODE	NATIONAL STOCK NUMBER	FSCM	PART NUMBER	DESCRIPTION USABLE ON CODE	U/M	QTY INC IN UNIT
						0103-FLYWHEEL ASSEMBLY		
5	1	XDFZZ		15434	3001646	SCREW,CAPTIVE COVER PLATE MOUNTING................	EA	2
5	2	PAFZZ	5330-01-082-6985	15434	3021735	GASKET PART OF KIT P/N 3018762....................	EA	1
5	3	PBFZZ	2815-01-122-8002	15434	70657	PLATE,COVER ACCESS TO FLYWHEEL ASSEMBLY HOUSING INDEX HOLE..	EA	1
5	4	PCFZZ	5330-00-404-2920	15434	172648	PACKING,PREFORMED PART OF KIT P/N 3018762..........	EA	11
5	5	PAFZZ	2815-01-160-5820	15434	3016637	FLYWHEEL HOUSING AS CRANKSHAFT MOUNTED............	EA	1
5	6	PAFZZ	5310-00-134-4168	15434	S601	WASHER OIL PAN....................................	EA	4
5	7	PAFZZ	5310-00-584-5272	96906	MS35338-48	WASHER,LOCK FLYWHEEL HOUSING TO CRANKCASE..........	EA	2
5	8	XDFZZ		15434	3012483	SCREW,CAP FLYWHEEL HOUSING TO CRANKCASE............	EA	4
5	9	PAFZZ	5305-00-795-9336	15434	204165	SCREW,CAP...	EA	6
5	10	PAFZZ	5310-00-134-4171	15434	200861	WASHER,FLAT.......................................	EA	6
5	11	PAFFF	2815-01-085-1881	15434	BM66317	FLYWHEEL,ENGINE...................................	EA	1
5	12	XAFZZ		15434	129594	.FLYWHEEL,ENGINE CRANKSHAFT TO CLUTCH ASSEMBLY.....	EA	1
5	13	PAFZZ	3020-00-528-5053	15434	4797	.GEAR,SPUR..	EA	1
5	14	XDFZZ		15434	S1898	SCREW,CAP...	EA	9
5	15	PAFZZ	5310-00-081-8500	15434	127316	WASHER,RECESSED...................................	EA	9
5	16	PAFZZ	5305-00-091-4009	15434	106289	SCREW,CAP FLYWHEEL HOUSING TO CRANKCASE...........	EA	2
5	17	PBFZZ	4730-01-106-0202	15434	3008469	PLUG,PIPE FLYWHEEL HOUSING MOUNTED................	EA	1
5	18	PAFZZ	5310-00-469-3998	15434	S200	NUT,HEX...	EA	2
5	19	PAFZZ	5315-00-014-1284	15434	9226	PIN,STRAIGHT FLYWHEEL HOUSING MOUNTING............	EA	2
5	20	PAFZZ	4730-00-018-9566	15434	S911B	PLUG,PIPE FLYWHEEL HOUSING MOUNTED................	EA	1

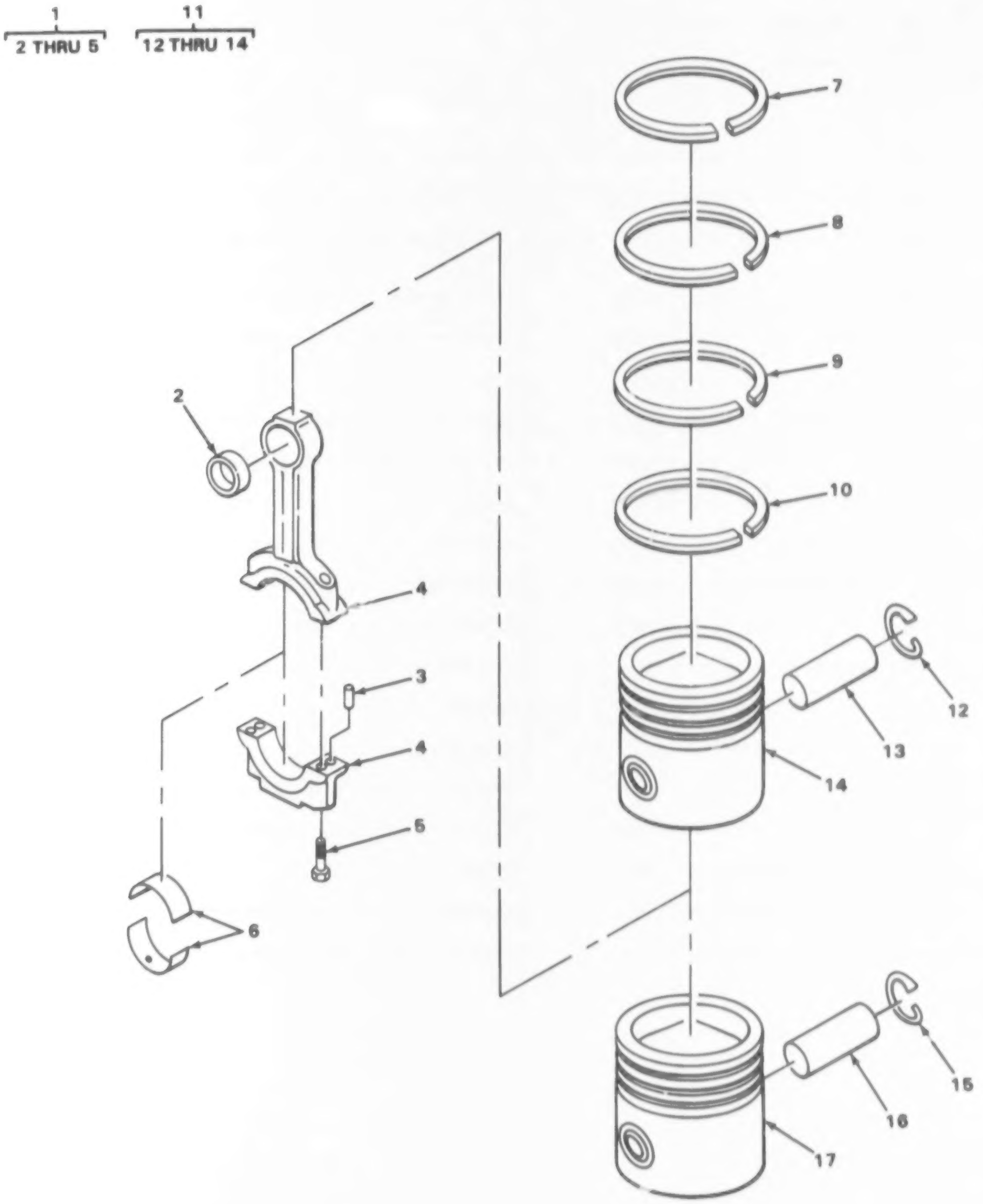
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FIGURE 6. PISTON AND CONNECTING ROD ASSEMBLY.

(1) ILLUSTRATION		(2)	(3)	(4)	(5)	(6)	(7)	(8)
(a) FIG. NO.	(b) ITEM NO.	SMR CODE	NATIONAL STOCK NUMBER	FSCM	PART NUMBER	DESCRIPTION USABLE ON CODE	U/M	QTY INC IN UNIT
						0104-PISTONS, CONNECTING RODS		
6	1	PAHHH	2815-01-086-4508	15434	3013930	CONNECTING ROD PISTON	EA	6
6	2	PAHZZ	2815-00-132-0273	15434	187420	.BEARING,SLEEVE CONNECTING ROD TO PISTON PIN	EA	1
6	3	XDHZZ		15434	70550	.PIN,STRAIGHT CONNECTING ROD ASSEMBLY MOUNTING	EA	2
6	4	XAHZZ		15434	218808	.ROD ENGINE CONNECTING	EA	1
6	5	PAHZZ	5306-01-079-7027	15434	219153	.BOLT,MACHINE CONNECTING ROD ASSEMBLY MOUNTING	EA	2
6	6	PAHZZ	3120-01-087-3004	15434	214950	BEARING HALF CONNECTING ROD TO CRANKSHAFT ROD JOURNAL	EA	12
6	7	PAHZZ	2815-00-994-4427	15434	147670	RING,PISTON PART OF KIT P/N 3014149	EA	6
6	8	KFHZZ		15434	3012332	RING,PISTON PART OF KIT P/N 3014149	EA	6
6	9	KFHZZ		15434	214730	RING,COMPRESSION PART OF KIT P/N 3014149	EA	6
6	10	KFHZZ		15434	218732	RING,PISTON,OIL PART OF KIT P/N 3014149	EA	6
6	11	PAHHH	2815-01-086-1422	15434	3008172	PISTON ASSY,ENGINE USE WITH CPL324	EA	6
6	12	PAHZZ	5365-00-282-5030	15434	61908	.RING,SNAP PISTON PIN MOUNTING	EA	2
6	13	PAHZZ	2815-00-480-4347	15434	191970	.PIN,PISTON PISTON TO CONNECTING ROD	EA	1
6	14	PAHZZ	2815-01-077-1482	15434	3008472	.PISTON,INTERNAL COM OLD,DO NOT INTERCHANGE OLD AND NEW PISTONS	EA	1
6	15	PAHZZ	5365-00-282-5030	15434	61908	RING,SNAP PISTON PIN MOUNTING,USE WITH CPL393	EA	12
6	16	PAHZZ	2815-00-480-4347	15434	191970	PIN,PISTON PISTON TO CONNECTING ROD,USE WITH CPL393	EA	6
6	17	PAHZZ	2815-01-168-3742	15434	216020	PISTON,INTERNAL COM NEW,USE WITH CPL393 DO NOT INTERCHANGE OLD AND NEW PISTONS	EA	6
6		PAHZZ	2815-01-086-2704	15434	3014149	RING SET,PISTON	EA	1
6	7					RING,PISTON	EA	6
6	8					RING,PISTON	EA	6
6	9					RING,COMPRESSION	EA	6
6	10					RING,PISTON,OIL	EA	6

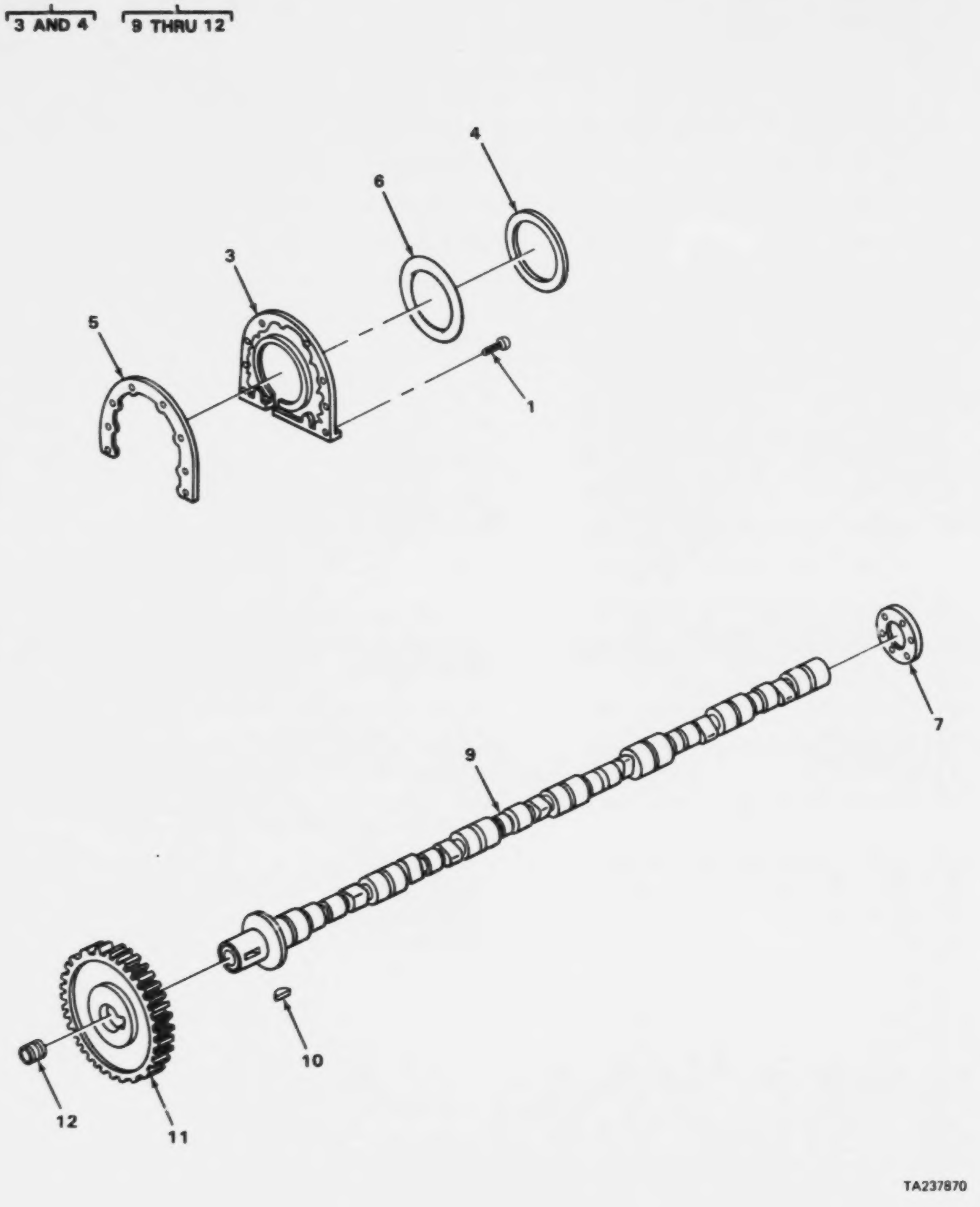
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FIGURE 7. CAMSHAFT ASSEMBLY AND REAR COVER.

(1) ILLUSTRATION		(2)	(3)	(4)	(5)	(6)	(7)	(8)
(a) FIG. NO.	(b) ITEM NO.	SMR CODE	NATIONAL STOCK NUMBER	FSCM	PART NUMBER	DESCRIPTION USABLE ON CODE	U/M	QTY INC IN UNIT
						0105-VALVES, CAMSHAFTS AND TIMING SYSTEMS		
7	1	PBHZZ	5305-01-130-6100	15434	3010594	SCREW,CAP	EA	8
7	2	PAHHH		15434	AR51959	PLATE ASSEMBLY REAR COVER	EA	1
7	3	PAHZZ	2990-01-120-2883	15434	216165	.COVER,REAR	EA	1
7	4	PAHZZ	5330-01-086-6112	15434	3006738	.SEAL,OIL	EA	1
7	5	PAHZZ	5330-00-361-2955	15434	40662-A	GASKET PART OF KIT P/N 3018762	EA	1
7	6	PCHZZ	5330-00-452-1748	15434	137075	PACKING,PREFORMED REAR COVER PLATE ASSEMBLY	EA	1
7	7	PAHZZ	3120-01-079-8194	15434	215233	BEARING,WASHER THRU	EA	1
7	8	AHHHH		15434	3009554	CAMSHAFT ASSEMBLY	EA	1
7	9	PAHZZ	2815-01-079-3380	15434	3801047	.CAMSHAFT,ENGINE	EA	1
7	10	PAHZZ	5315-01-086-6187	15434	3012328	.KEY,OFFSET	EA	1
7	11	PAHZZ	3020-00-424-9995	15434	215966	.GEAR,CAMSHAFT CAMSHAFT TO CRANKSHAFT GEAR	EA	1
7	12	PAHZZ	5340-00-404-2944	15434	68193	.PLUG,PIPE ORIFICED,CAMSHAFT TO CAMSHAFT GEAR	EA	1

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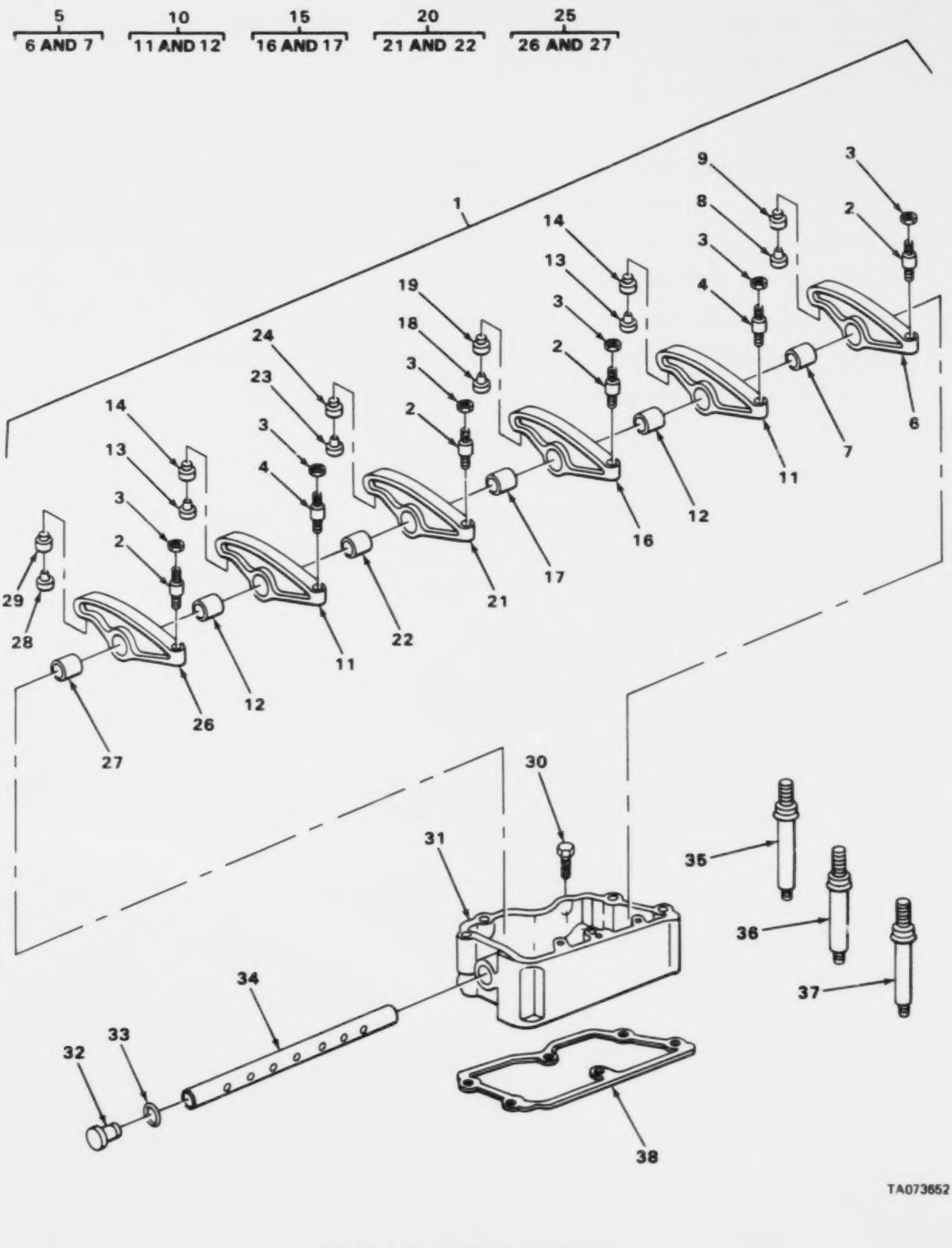
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FIGURE 8. ROCKER ARM ASSEMBLY.

(1) ILLUSTRATION		(2)	(3)	(4)	(5)	(6)	(7)	(8)
(a) FIG. NO.	(b) ITEM NO.	SMR CODE	NATIONAL STOCK NUMBER	FSCM	PART NUMBER	DESCRIPTION USABLE ON CODE	U/M	QTY INC IN UNIT
						0105(CONT)		
8	1	PAFFF	2815-01-085-2569	15434	AR03307	ROCKER ARM ASSEMBLY	EA	3
8	2	PAFZZ	5305-00-947-3437	15434	168306	.SETSCREW	EA	4
8	3	PAFZZ	5310-00-732-0560	96906	MS51968-14	.NUT,PLAIN,HEXAGON ADJUST LOCK	EA	6
8	4	PAFZZ	5307-01-109-5972	75078	1764	.SCREW INJECTOR ADJUSTING	EA	2
8	5	PAFFF	2815-00-851-7637	15434	BM95162	.ROCKER ARM ENGINE	EA	1
8	6	XAFZZ		15434	169705	..LEVER ROCKER ARM	EA	1
8	7	PAFZZ	3120-00-589-3537	15434	140330	..BEARING,SLEEVE	EA	1
8	8	XDFZZ		15434	208084	..RIVET,BLIND	EA	1
8	9	PAFZZ	2815-00-404-2940	15434	194037	..SEAT BALL SOCKET	EA	1
8	10	PAFFF	2815-00-005-7431	15434	AR-2308	.LEVER INJECTOR FUEL	EA	2
8	11	XAFZZ		15134	218152	..LEVER ROCKER ARM	EA	1
8	12	PAFZZ	3120-01-079-5208	15434	218153	..BUSHING,SLEEVE	EA	1
8	13	XDFZZ		15434	208084	..RIVET,BLIND	EA	1
8	14	PAFZZ	2815-00-404-2940	15434	194037	..SEAT BALL SOCKET	EA	1
8	15	PAFFF	2815-00-195-5897	15434	BM95160	.ROCKER ARM,ENGINE	EA	1
8	16	XAFZZ		15434	168803	..LEVER ROCKER ARM INTAKE	EA	1
8	17	PAFZZ	3120-00-589-3537	15434	140330	..BUSHING,SLEEVE	EA	1
8	18	XDFZZ		15434	208084	..RIVET,BLIND	EA	1
8	19	PAFZZ	2815-00-404-2940	15434	194037	..SEAT BALL SOCKET	EA	1
8	20	PAFFF	2810-00-195-5894	15434	AR51276	.LEVER ROCKER ARM	EA	1
8	21	XAFZZ		15434	168805	..LEVER ROCKER ARM INTAKE	EA	1
8	22	PAFZZ	3120-00-589-3537	15434	140330	..BUSHING,SLEEVE	EA	1
8	23	XDFZZ		15434	208084	..RIVET,BLIND	EA	1
8	24	PAFZZ	2815-00-404-2940	15434	194037	..SEAT BALL SOCKET	EA	1
8	25	PAFFF	2815-01-096-9198	15434	BM95161	.LEVER ROCKER ARM EXHAUST	EA	1
8	26	XAFZZ		15434	169704	..LEVER ROCKER ARM	EA	1
8	27	PAFZZ	3120-00-589-3537	15434	140330	..BEARING,SLEEVE	EA	1
8	28	XDFZZ		15434	208084	..RIVET,BLIND	EA	1
8	29	PAFZZ	2815-00-404-2940	15434	194037	..SEAT BALL SOCKET	EA	1

(1) ILLUSTRATION (a) FIG. NO.	(1) ILLUSTRATION (b) ITEM NO.	(2) SMR CODE	(3) NATIONAL STOCK NUMBER	(4) FSCM	(5) PART NUMBER	(6) DESCRIPTION	(6) USABLE ON CODE	(7) U/M	(8) QTY INC IN UNIT
						0105(CONT)			
8	30	PAFZZ	2520-01-085-6128	75078	002969	.SCREW SHAFT LOCK		EA	1
8	31	PAFZZ	2815-00-230-0070	15434	3007242	.HOUSING ROCKER LEVERS		EA	1
8	32	PBFZZ	4730-01-124-0293	75078	218736	.PLUG MACHINE THREAD		EA	2
8	33	PCFZZ	5330-01-084-9067	15434	3000521	.PACKING,PREFORMED		EA	2
8	34	PAFZZ	2815-01-079-1799	15434	140297	.SHAFT,STRAIGHT		EA	1
8	35	XDFZZ		15434	2856	STUD MACHINE THREAD		EA	2
8	36	XDFZZ		15434	1199	STUD MACHINE THREAD		EA	8
8	37	XDFZZ		75078	1232	STUD MACHINE THREAD		EA	8
8	38	PAFZZ	5330-00-861-8592	15434	3017750	GASKET PART OF KIT P/N 3801350		EA	3

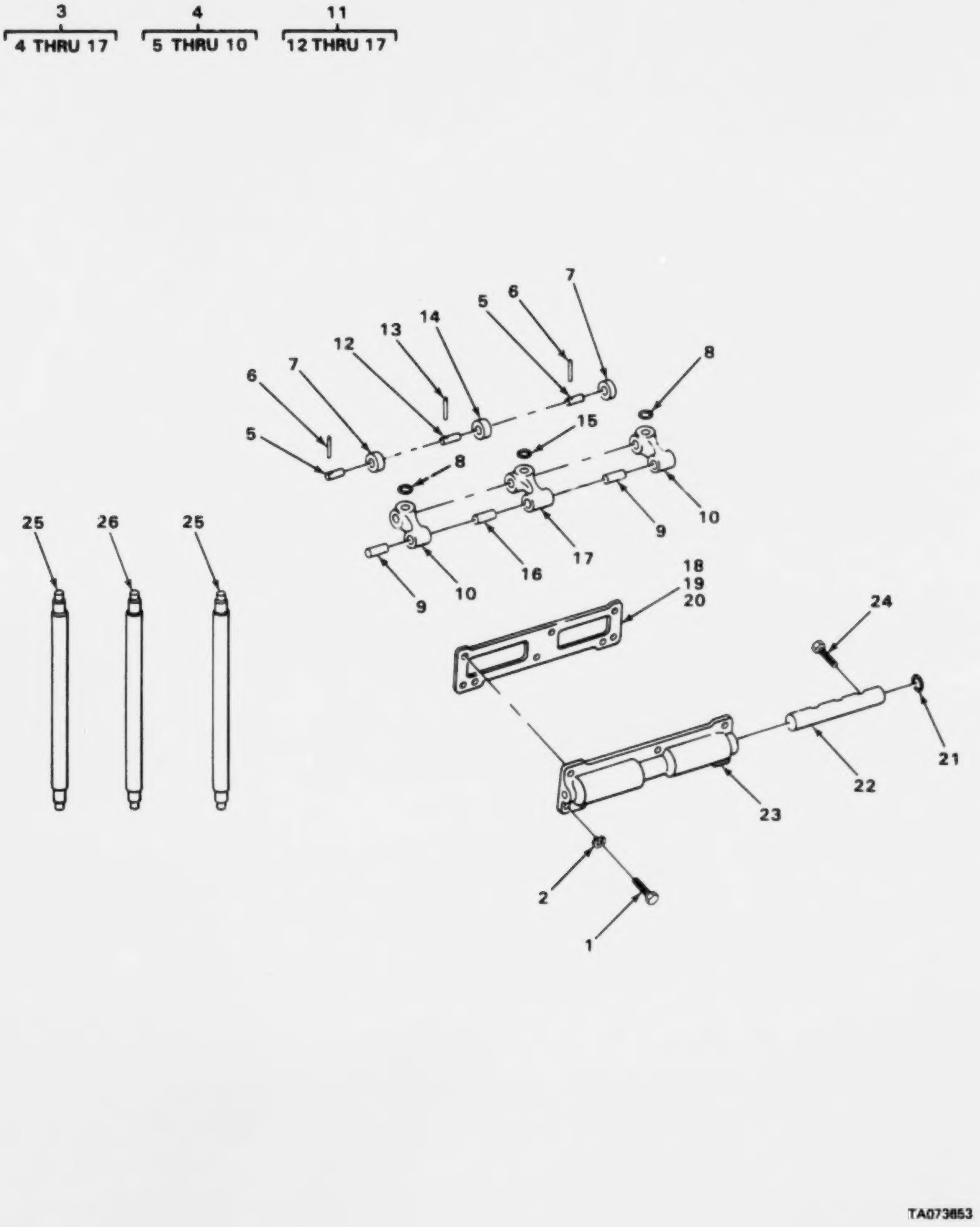
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FIGURE 9. CAM FOLLOWER ASSEMBLY, HOUSING AND PUSH TUBES.

(1) ILLUSTRATION (a) FIG. NO.	(1) ILLUSTRATION (b) ITEM NO.	(2) SMR CODE	(3) NATIONAL STOCK NUMBER	(4) FSCM	(5) PART NUMBER	(6) DESCRIPTION	(6) USABLE ON CODE	(7) U/M	(8) QTY INC IN UNIT
						0105(CONT)			
9	1	PAHZZ	5306-00-546-6698	15434	S129	SCREW,CAP,HEXAGON H		EA	6
9	2	PAHZZ	5310-00-261-7340	15434	S604	WASHER,LOCK		EA	6
9	3	AHHHH		15434	3017042	CAM FOLLOWER ASSEMBLY		EA	3
9	4	PAHHH	2815-01-086-3975	15434	3017041	.LEVER CAM FOLLOWER		EA	4
9	5	XDHZZ		15434	3002069	..PIN,SPRING		EA	1
9	6	PAHZZ	5315-00-777-3544	15434	118939	..PIN,STRAIGHT,HEADLE		EA	1
9	7	PAHZZ	3120-01-080-5482	15434	3005919	..ROLLER,LINEAR ROTOR		EA	1
9	8	PAHZZ	2815-01-048-6702	15434	213559	..BUSHING SLEEVE		EA	1
9	9	PAHZZ	3120-00-659-7808	15434	118378	..BEARING,SLEEVE		EA	1
9	10	XAHZZ		15434	3017033	..LEVER CAM FOLLOWER		EA	1
9	11	PAHHH	2815-01-086-9757	15434	3017040	.LEVER CAM FOLLOWER		EA	2
9	12	PAHZZ	5315-00-777-3544	15434	118939	..PIN,STRAIGHT,HEADLE		EA	1
9	13	XDHZZ		15434	219107	..PIN,SPRING		EA	1
9	14	PAHZZ	3120-01-079-5451	15434	3005920	..ROLLER,LINEAR ROTOR		EA	1
9	15	PAHZZ	2815-00-505-5119	15434	107738	..INSERT ROCKER ARM		EA	1
9	16	PAHZZ	3120-00-791-1440	15434	118377	..BUSHING SLEEVE		EA	1
9	17	XAHZZ		15434	3017032	..LEVER CAM FOLLOWER		EA	1
9	18	PAHZZ	5330-01-066-5347	15434	3020003	.GASKET .022 IN.THICK PART OF KIT P/N 3018762		EA	V
9	19	PAHZZ	5330-01-066-5348	15434	3020002	.GASKET .017 IN.THICK PART OF KIT P/N 3018762		EA	V
9	20	PAHZZ	5330-01-066-5349	15434	3020000	.GASKET PART OF KIT P/N 3018762		EA	1
9	21	PAHZZ	5340-00-485-0945	15434	175831	.PLUG,EXPANSION		EA	2
9	22	XDHZZ		15434	3017031	.SHAFT CAM FOLLOWER		EA	2
9	23	XDHZZ		15434	3016887	.HOUSING CAM FOLLOWER		EA	1
9	24	PAHZZ	5305-00-339-1415	15434	69736	.SCREW,LOCK		EA	2
9	25	PAHZZ	2815-01-085-5190	15434	AR11780	TUBE,PUSH		EA	12
9	26	PAHZZ	2815-01-146-1042	15434	3032681	TUBE,PUSH INJECTORS		EA	6

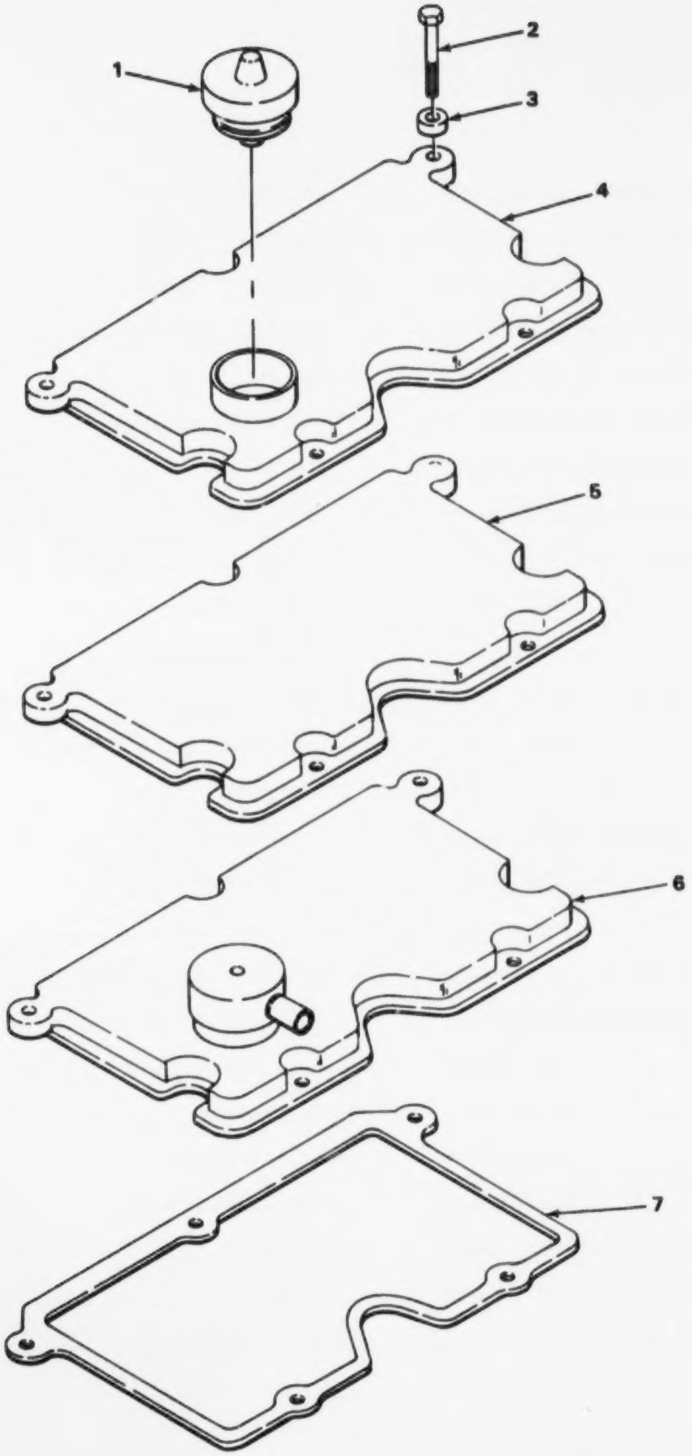

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FIGURE 10. ROCKER COVERS.

(1) ILLUS-TRATION (a) FIG. NO.	(1) ILLUS-TRATION (b) ITEM NO.	(2) SMR CODE	(3) NATIONAL STOCK NUMBER	(4) FSCM	(5) PART NUMBER	(6) DESCRIPTION	(6) USABLE ON CODE	(7) U/M	(8) QTY INC IN UNIT
						0105(CONT)			
10	1	PAOZZ	2815-00-590-7378	15434	101322	CAP,FILLER		EA	1
10	2	PBOZZ	5305-01-118-8826	15434	3006182	SCREW,CAP,HEXAGON H		EA	15
10	3	PBOZZ		15434	64709	SPACER,SLEEVE COVER TO ENGINE RETARDER		EA	15
10	4	PBOZZ	2815-01-164-6103	15434	3006349	COVER,FILLER ROCKER AND RETARDER		EA	1
10	5	PAOZZ	2815-01-142-1732	15434	3006183	COVER,BLANK ROCKER AND RETARDER		EA	1
10	6	PAOZZ	2815-01-146-1024	15434	3006358	COVER,BREATHER ROCKER AND RETARDER		EA	1
10	7	PAOZZ	5330-01-066-3908	15434	3044514	GASKET PART OF KIT P/N 3801350		EA	3

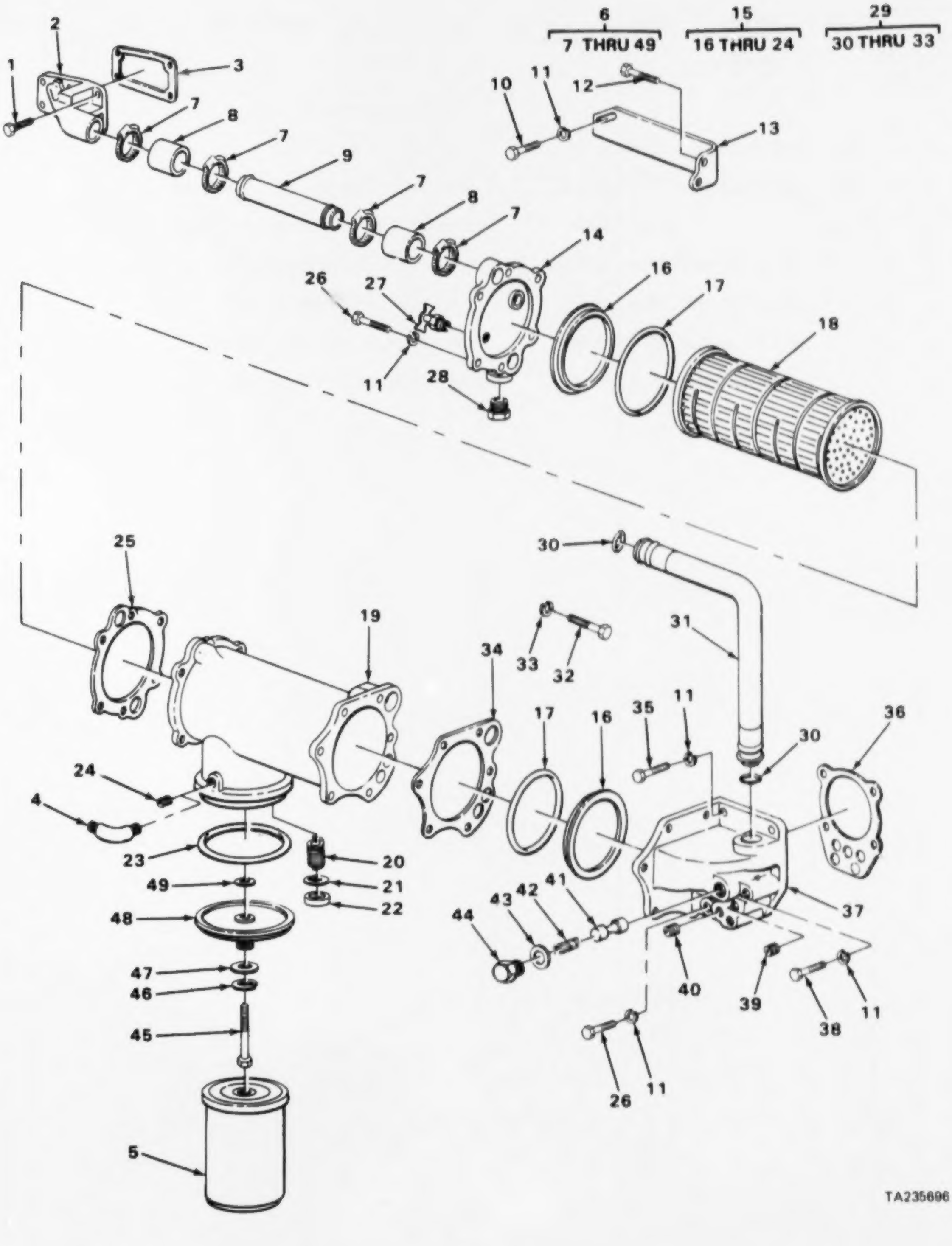
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FIGURE 11. OIL COOLER AND FILTER.

(1) ILLUS-TRATION (a) FIG. NO.	(1) ILLUS-TRATION (b) ITEM NO.	(2) SMR CODE	(3) NATIONAL STOCK NUMBER	(4) FSCM	(5) PART NUMBER	(6) DESCRIPTION USABLE ON CODE	(7) U/M	(8) QTY INC IN UNIT
						0106-ENGINE LUBRICATION SYSTEM		
11	1	XDFZZ		15434	3011342	SCREW,ASSEMBLED WAS	EA	6
11	2	XDFZZ		15434	3011233	CONNECTION WATER HEADER	EA	1
11	3	PAHZZ	5330-00-537-2382	15434	70089-1	GASKET PART OF KIT P/N 3018762	EA	1
11	4	PAFZZ	4730-00-254-6227	79470	49X2	ELBOW,PIPE	EA	1
11	5	PAOZZ	2940-01-019-4513	33457	LF670	FILTER OIL LUBRICATING	EA	1
11	6	PAFHH	2520-01-080-4473	15434	3003814	COOLER,OIL LUBRICATING	EA	1
11	7	XDFZZ		15434	3008690	.CLAMP,HOSE	EA	4
11	8	PCFZZ	4720-01-085-2571	15434	3018059	.HOSE	EA	2
11	9	XDFZZ		15434	3000907	.PIPE WATER TRANSFER	EA	1
11	10	PAFZZ	5305-00-782-9495	15434	S145	.SCREW,CAP,HEXAGON H	EA	1
11	11	PAFZZ	5310-00-584-5272	96906	MS35338-48	.WASHER,LOCK	EA	12
11	12	PBHZZ	5305-01-085-8197	15434	3010595	.SCREW,CAP,CAPTIVE	EA	2
11	13	XDFZZ		15434	210966	.BRACKET,ANGLE	EA	1
11	14	XDHZZ		15434	217315	.COVER,PRESSURE OIL COOLER	EA	1
11	15	XDHHH		15434	AR09999	.COOLER,OIL	EA	1
11	16	XDHZZ		15434	3006745	..RETAINER,PACKING	EA	2
11	17	PAHZZ	5330-01-086-6197	15434	3007713	..PACKING,PREFORMED	EA	2
11	18	PAFZZ	2930-01-065-7113	15434	208149	..ELEMENT OIL COOLER	EA	1
11	19	XDHZZ		15434	210915	..HOUSING OIL COOLER	EA	1
11	20	XDHZZ		15434	202128	..SPRING,HELICAL	EA	1
11	21	XAHZZ		15434	210707	..DISC,BYPASS	EA	1
11	22	XDHZZ		15434	179063	..SEAT,BYPASS FILTER	EA	1
11	23	PCFZZ	5330-00-132-0248	15434	173368	..PACKING,PREFORMED PART OF KIT P/N 3018762	EA	1
11	24	PAHZZ	4730-00-018-9566	15434	S911B	..PLUG,PIPE	EA	1
11	25	PAFZZ	5330-01-046-1991	15434	218245	.GASKET PART OF KIT P/N 3018762	EA	1
11	26	PBFZZ	5305-01-086-7036	15434	3010597	.SCREW,CAP	EA	9
11	27	PAFZZ	4820-00-276-9041	15434	107947	.COCK,DRAIN	EA	1
11	28	PAFZZ	4730-00-010-3867	96906	MS51884-5	.PLUG,PIPE OIL	EA	1
11	29	AFFFF		15434	AR09480	.PIPE,WATER TRANSFER ASSEMBLY	EA	1

(1) ILLUSTRATION (a) FIG. NO.	(1) ILLUSTRATION (b) ITEM NO.	(2) SMR CODE	(3) NATIONAL STOCK NUMBER	(4) FSCM	(5) PART NUMBER	(6) DESCRIPTION USABLE ON CODE	(7) U/M	(8) QTY INC IN UNIT
						0106(CONT)		
11	30	PCFZZ	5330-01-077-5228	15434	212161	..PACKING,PREFORMED PART OF KIT P/N 3801350	EA	2
11	31	PAFZZ	4710-01-085-6130	15434	211027	..PIPE,WATER TRANSFER	EA	1
11	32	PBFZZ	5310-01-114-9279	15434	S110	..SCREW,CAP,HEXAGON H	EA	1
11	33	PAFZZ	5310-00-407-9566	96906	MS35338-45	..WASHER,LOCK	EA	1
11	34	PAFZZ	5330-01-046-3144	15434	3010030	.GASKET	EA	1
11	35	PAFZZ	5305-00-269-3213	15434	S103D	.SCREW,CAP,CAPTIVE	EA	2
11	36	PAFZZ	5330-01-079-6514	15434	3008017	.GASKET	EA	1
11	37	XDFZZ		15434	210967	.SUPPORT OIL COOLER	EA	1
11	38	PBFZZ	5305-01-121-0355	15434	S106C	.SCREW,CAP,HEXAGON H	EA	2
11	39	XDHZZ		15434	142110	.PLUG,PIPE	EA	1
11	40	XDHZZ		15434	3008466	.PLUG,PIPE OIL	EA	1
11	41	PAHZZ	2815-00-791-1453	15434	127558	.PLUNGER REGULATOR,PRESSURE OIL PRESSURE	EA	1
11	42	PAHZZ	5360-00-664-5343	15434	68274	.SPRING,HELICAL COMPRESSION	EA	1
11	43	PAHZZ	5365-00-197-9327	15434	67946	.GASKET PART OF KIT P/N 3018762	EA	1
11	44	PBHZZ	5365-01-112-4281	15434	183913	.CAP,REGULATOR	EA	1
11	45	XDHZZ		15434	S152B	.SCREW,CAP,HEXAGON H	EA	1
11	46	XDHZZ		15434	70216	.WASHER,LOCK	EA	1
11	47	XDHZZ		15434	203310	.WASHER,FLAT	EA	1
11	48	PAHZZ	2940-01-065-7076	33457	3300922S	.ADAPTER FILTER ASSEMBLY	EA	1
11	49	PAHZZ	5330-01-071-7687	15434	33008958	.SEAL,RING PART OF KIT P/N 3018762	EA	1

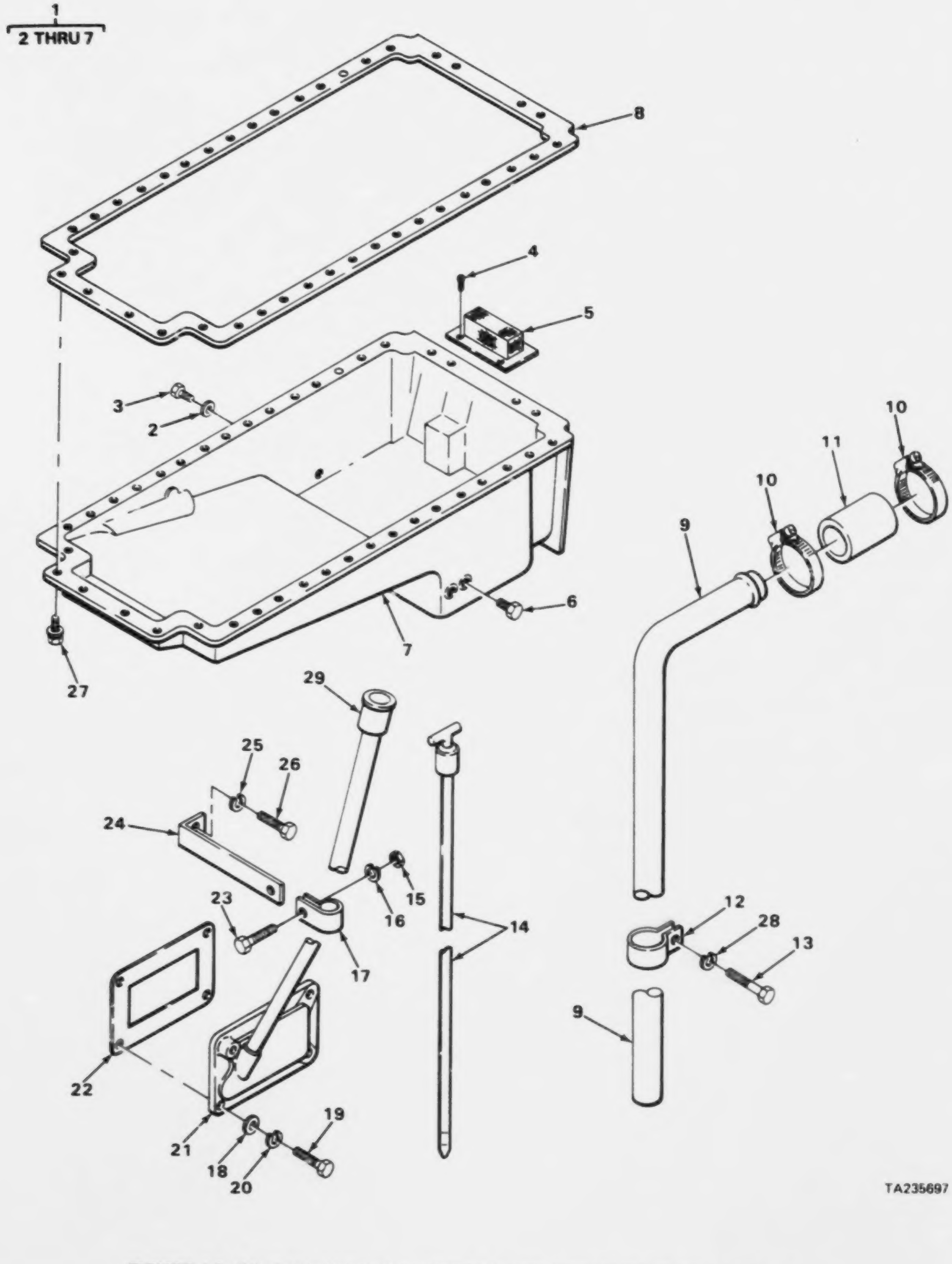
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FIGURE 12. OIL PAN ASSEMBLY, DIPSTICK AND BREATHER TUBE ASSEMBLY.

(1) ILLUSTRATION (a) FIG. NO.	(b) ITEM NO.	(2) SMR CODE	(3) NATIONAL STOCK NUMBER	(4) FSCM	(5) PART NUMBER	(6) DESCRIPTION	USABLE ON CODE	(7) U/M	(8) QTY INC IN UNIT
						0106(CONT)			
12	1	PAFFF		15434	AR05911	PAN,OIL ASSEMBLY		EA	1
12	2	PCOZZ	5365-00-197-9327	15434	67946	.SPACER,RING		EA	1
12	3	PAOZZ	4730-00-010-3867	96906	MS51884-5	.PLUG,PIPE		EA	1
12	4	PAFZZ	5305-00-804-6454	15434	S1354	.SCREW TAPPING THREAD		EA	4
12	5	PAFZZ	2910-00-338-6839	34623	MA207-21139	.STRAINER,ELEMENT		EA	1
12	6	PAOZZ	5365-00-695-1247	15434	69962	.PLUG,MACHINE THREAD		EA	1
12	7	PAFZZ	2815-01-133-2445	15434	193625	.PAN,OIL		EA	1
12	8	PAFZZ	5330-00-351-6428	15434	3031469	GASKET PART OF KIT P/N 3018762		EA	1
12	9	PBOZZ		15434	3008599	TUBE,BREATHER		EA	1
12	10	PAOZZ	4730-01-146-3111	15434	3008596	CLAMP,HOSE TO BREATHER AND TUBE		EA	2
12	11	PCOZZ	4720-00-361-2989	15434	64775	HOSE,NON-METALLIC		EA	1
12	12	PAOZZ	5340-00-839-0653	15434	68425	CLAMP,LOOP		EA	1
12	13	PAOZZ	5305-00-177-5552	15434	S126	SCREW,CAP,HEXAGON H		EA	1
12	14	PAOZZ	6680-01-108-7410	15434	3017292	GAGE ROD,LIQUID LEV		EA	1
12	15	PAFZZ	5310-01-126-9404	24617	9422277	NUT,HEX CLAMP BRACKET		EA	1
12	16	PAFZZ	5310-00-261-7340	96905	MS35338-8	WASHER,LOCK CLAMP BRACKET TO TUBE		EA	1
12	17	PAFZZ	5340-00-417-5800	15434	65798	CLAMP,BRACKET		EA	1
12	18	PAFZZ	5310-00-080-6004	96906	MS27183-14	WASHER,FLAT BRACKET,OIL TUBE TO BLOCK		EA	4
12	19	PAFZZ	5305-00-269-3211	96906	MS90725-60	SCREW,CAP,HEX HEAD BRACKET,OIL TUBE TO BLOCK		EA	4
12	20	PAFZZ	5310-00-637-9541	96906	MS35338-46	WASHER,LOCK BRACKET,OIL TUBE TO BLOCK		EA	4
12	21	PAFZZ	5340-01-140-7158	15434	178074	BRACKET,OIL TUBE HAND HOLE COVER		EA	1
12	22	PAFZZ	5330-00-246-0309	15434	65274	GASKET PART OF KIT P/N 3018762		EA	1
12	23	XDFZZ		24617	9418967	SCREW,CAP,HEX HEAD CLAMP BRACKET TO TUBE		EA	1
12	24	PBFZZ		15434	134561	BRACKET,MOUNTING		EA	1
12	25	PAFZZ	5310-00-010-3322	96906	MS35338-9	WASHER,LOCK		EA	1
12	26	PAFZZ	5305-00-069-5584	96906	MS90725-100	SCREW,CAP,HEX HEAD MOUNTING BRACKET TO BLOCK		EA	1
12	27	XDFZZ		15434	3008069	SCREW ASSEMBLED WAS BAR AND PAN TO GEAR COVER,REAR COVER AND ENGINE BLOCK		EA	28
12	28	PAOZZ	5310-00-261-7340	96906	MS35338-8	WASHER,LOCK		EA	1

(1) ILLUSTRATION		(2) SMR CODE	(3) NATIONAL STOCK NUMBER	(4) FSCM	(5) PART NUMBER	(6) DESCRIPTION	USABLE ON CODE	(7) U/M	(8) QTY INC IN UNIT
(a) FIG. NO.	(b) ITEM NO.								
						0106(CONT)			
12	29	PAFZZ	4710-01-142-1667	15434	3022377	BREATHER TUBE,OIL..................................		EA	1

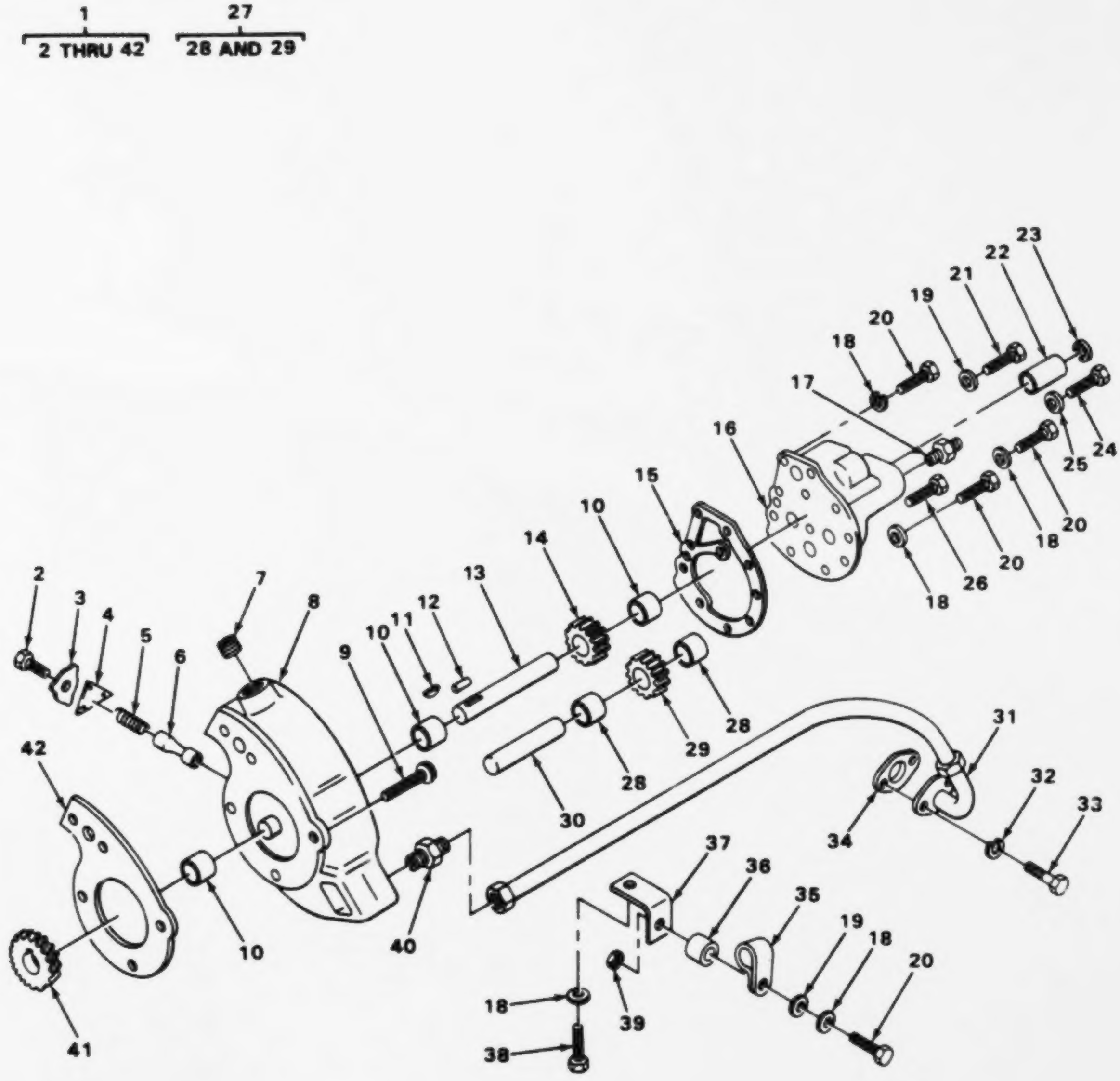
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FIGURE 13. OIL LUBRICATING PUMP ASSEMBLY.

(1) ILLUS-TRATION (a) FIG. NO.	(1) ILLUS-TRATION (b) ITEM NO.	(2) SMR CODE	(3) NATIONAL STOCK NUMBER	(4) FSCM	(5) PART NUMBER	(6) DESCRIPTION USABLE ON CODE	(7) U/M	(8) QTY INC IN UNIT
						0106(CONT)		
13	1	PAFHH	2815-01-085-2573	15434	AR10172	PUMP ASSEMBLY OIL LUBE	EA	1
13	2	PAHZZ	5305-01-010-2362	96906	MS90725-59	.SCREW,CAP,HEX HEAD	EA	1
13	3	PAHZZ	2815-00-406-8936	15434	109319	.PLATE,LOCK	EA	1
13	4	PAHZZ	2815-00-828-7013	15434	126304	.YOKE CAP RETAINING	EA	1
13	5	PAHZZ	5360-01-038-4659	15434	211939	.SPRING BYPASS VALVE	EA	1
13	6	PAHZZ	2815-00-705-2856	15434	109333	.PLUNGER PRESSURE	EA	1
13	7	PAHZZ	4730-01-106-0202	15434	3008469	.PLUG,PIPE	EA	1
13	8	PAHZZ	2815-01-085-3734	15434	AR9832	.BODY AND BUSHING	EA	1
13	9	XDHZZ		15434	3012479	.SCREW,ASSEMBLED WAS	EA	2
13	10	PAHZZ	3120-00-627-6697	15434	69521	.BEARING,SLEEVE	EA	3
13	11	PAHZZ	5310-00-043-1787	96906	MS35756-34	.KEY,CRANKSHAFT	EA	1
13	12	PAHZZ	5315-00-475-2574	15434	69519	.PIN,DOWEL	EA	1
13	13	PAHZZ	3040-01-079-1748	15434	199587	.SHAFT,SHOULDERED	EA	1
13	14	PAHZZ	3020-01-084-9640	15434	3014783	.GEAR,LUBE OIL PUMPING	EA	1
13	15	PAHZZ	5330-01-066-3910	15434	203145	.GASKET PART OF KIT P/N 3018762	EA	1
13	16	XDHZZ		15434	AR8667	.HOUSING HYDRAULIC ADAPTER	EA	1
13	17	PAHZZ	4730-00-927-7272	34623	M/125-20027	.CONNECTOR,BRASS	EA	1
13	18	PAHZZ	5310-00-209-0965	15434	S610	.WASHER,LOCK	EA	5
13	19	PAHZZ	5310-00-562-6557	15434	S622	.WASHER,FLAT	EA	1
13	20	PAHZZ	5305-00-269-3213	15434	S103D	.SCREW,CAP,HEX HEAD	EA	3
13	21	XDHZZ		15434	117897	.SCREW,CAP,HEX HEAD	EA	1
13	22	PAHZZ	3010-01-079-1788	15434	199589	.COUPLING,HOSE	EA	1
13	23	PAHZZ	5365-01-084-9033	15434	100475	.RING,SNAP	EA	1
13	24	PAHZZ	5305-00-964-0565	96906	MS51095-374	.SCREW,CAP,HEX HEAD	EA	1
13	25	PAHZZ	5310-00-080-6004	96906	MS27183-14	.WASHER,FLAT	EA	1
13	26	PAHZZ	5305-00-225-9081	15434	MS90725-36	.SCREW,CAP,HEX HEAD	EA	1
13	27	PAHHH	3020-01-104-2334	15434	3014965	.GEAR	EA	1
13	28	PAHZZ	3120-00-566-0480	15434	68365	..BUSHING LUBE PUMP SPLIT	EA	2
13	29	XAHZZ		15434	3014784	..GEAR	EA	1

(1) ILLUS-TRATION (a) FIG. NO.	(b) ITEM NO.	(2) SMR CODE	(3) NATIONAL STOCK NUMBER	(4) FSCM	(5) PART NUMBER	(6) DESCRIPTION USABLE ON CODE	(7) U/M	(8) QTY INC IN UNIT
						0106(CONT)		
13	30	PAHZZ	3040-01-079-3469	15434	177419	.SHAFT,STRAIGHT....................................	EA	1
13	31	PAHZZ	4720-01-079-3285	34623	MA145B21000	.HOSE ASSEMBLY.....................................	EA	1
13	32	PAHZZ	5310-00-637-9541	96906	MS35338-46	.WASHER,LOCK.......................................	EA	2
13	33	PAHZZ	5305-00-426-4142	15434	S105	.SCREW,CAP,HEX HEAD................................	EA	2
13	34	PAHZZ	5330-00-143-8376	15434	157551	.GASKET PART OF KIT P/N 3018762....................	EA	1
13	35	PAHZZ	4730-01-085-6269	15434	105182	.CLAMP,HOSE..	EA	1
13	36	XDHZZ		15434	9674F	.SPACER..	EA	1
13	37	PAHZZ	5340-01-066-2947	15434	68038	.BRACKET,ANGLE.....................................	EA	1
13	38	XDHZZ		15434	3008060	.SCREW,CAP,HEX HEAD................................	EA	1
13	39	PAHZZ	5310-00-521-8595	15434	S223	.NUT,HEX SELF LOCKING..............................	EA	1
13	40	PAHZZ	4730-00-202-8470	01276	2021-20-205	.FITTING,HOSE......................................	EA	1
13	41	PAHZZ	3020-01-085-3779	15434	204832	.GEAR,DRIVE..	EA	1
13	42	PAFZZ	5330-00-033-9396	15434	3031434	.GASKET PART OF KIT P/N 3018762....................	EA	1

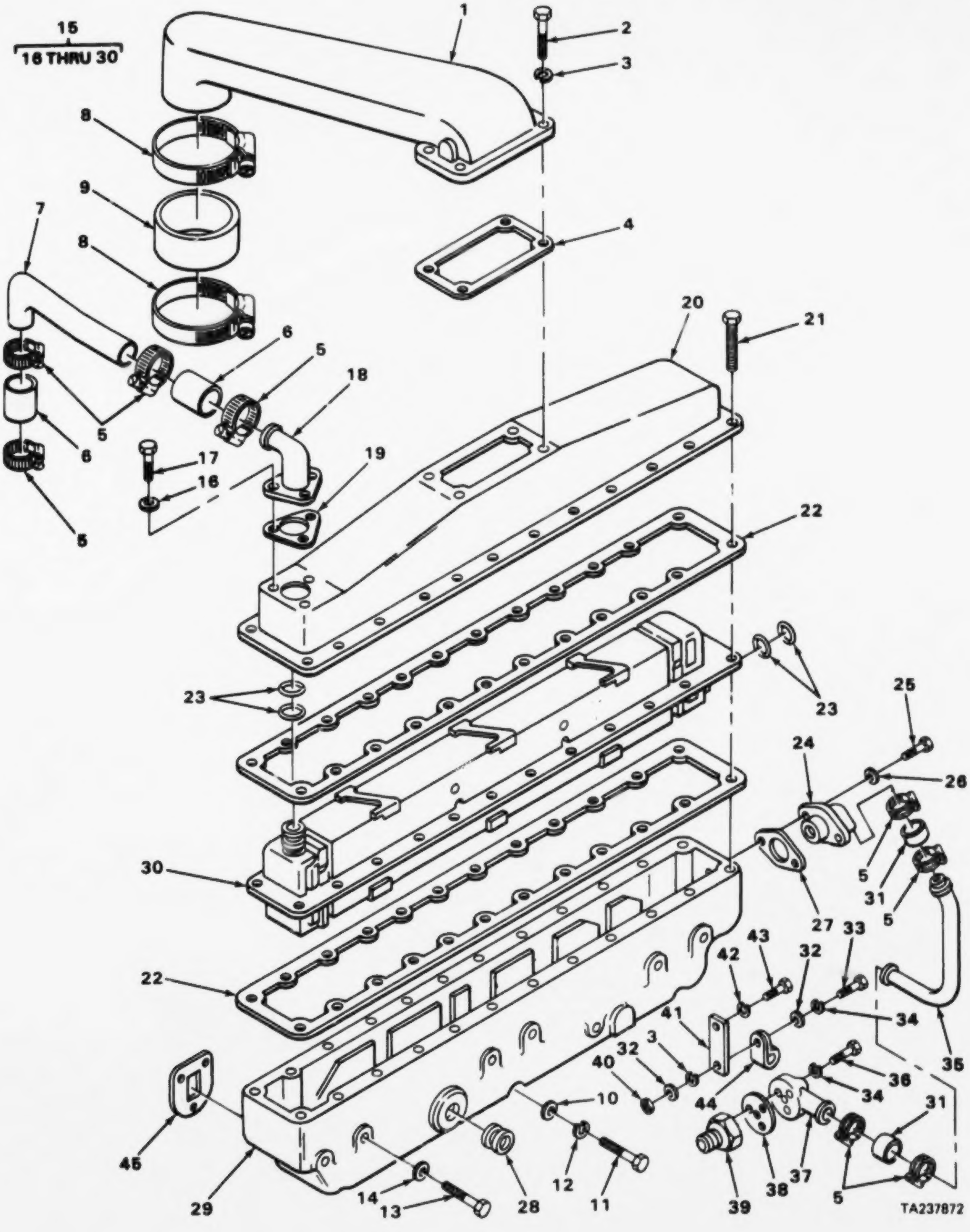
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FIGURE 14. AIR AFTERCOOLER ASSEMBLY.

(1) ILLUSTRATION (a) FIG. NO.	(1) ILLUSTRATION (b) ITEM NO.	(2) SMR CODE	(3) NATIONAL STOCK NUMBER	(4) FSCM	(5) PART NUMBER	(6) DESCRIPTION USABLE ON CODE	(7) U/M	(8) QTY INC IN UNIT
						0108-MANIFOLDS		
14	1	XDFZZ		15434	200488	CROSSOVER,AIR..	EA	1
14	2	PAFZZ	5305-00-269-3214	96906	MS90725-64	SCREW,CAP,HEXAGON H CROSSOVER TO COOLER............	EA	4
14	3	PAFZZ	5310-00-637-9541	96906	MS35338-46	WASHER,LOCK CROSSOVER TO COOLER	EA	5
14	4	PAFZZ	5330-01-072-8998	15434	216487	GASKET PART OF KIT P/N 3801350.....................	EA	1
14	5	PAFZZ	4730-00-555-8263	53496	A11	CLAMP,HOSE..	EA	8
14	6	PCFZZ	4720-01-085-6131	15434	155789	HOSE WATER TRANSFER OUTLET.........................	EA	2
14	7	PAFZZ	4730-01-085-6132	15434	215041	PIPE,WATER TRANSFER INLET..........................	EA	1
14	8	PAFZZ	4730-00-477-4160	15434	208326	CLAMP,HOSE TO TURBO-CHARGER AND CROSSOVER..........	EA	2
14	9	PCFZZ	4720-01-070-8149	15434	202994	HOSE,NON-METALLIC..................................	EA	1
14	10	PAFZZ	5310-00-134-4169	15434	63842	WASHER,FLAT AFTERCOOLER TO ENGINE BLOCK............	EA	3
14	11	PAFZZ	5305-00-269-3214	96906	MS90725-64	SCREW...	EA	3
14	12	PAFZZ	5310-00-159-6209	96906	MS122032	WASHER,LOCK CONNECTOR TO BLOCK.....................	EA	3
14	13	PAFZZ	5305-00-404-1390	15434	S149A	SCREW,CAP,HEXAGON H AFTERCOOLER TO ENGINE BLOCK....	EA	6
14	14	PAFZZ	5310-00-080-6004	96906	MS27183	WASHER,FLAT AFTERCOOLER TO ENGINE BLOCK............	EA	6
14	15	XDFFF		15434	AR12872	AFTERCOOLER AIR....................................	EA	1
14	16	PAFZZ	5330-00-003-1771	15434	S684	.WASHER,FLAT.......................................	EA	3
14	17	PAFZZ	5306-00-225-8499	96906	MS90725-34	.SCREW,CAP,HEXHEAD CONNECTOR WITH GASKET TO COOLER.	EA	3
14	18	XDFZZ		15434	215039	.CONNECTOR WATER OUTLET............................	EA	1
14	19	PAFZZ	5330-01-066-5357	15434	215044	.GASKET PART OF KIT P/N 3801350....................	EA	1
14	20	XDFZZ		15434	214154	.COVER AFTERCOOLER.................................	EA	1
14	21	XDFZZ		15434	3005508	.SCREW,CAP,HEXAGON H...............................	EA	24
14	22	PAFZZ	5330-01-066-5352	15434	216486	.GASKET PART OF KIT P/N 3801350....................	EA	2
14	23	PCFZZ	5330-01-066-3904	15434	195952	.PACKING,PREFORMED PART OF KIT P/N 3801350.........	EA	4
14	24	XDFZZ		15434	211222	.CONNECTOR WATER INLET.............................	EA	1
14	25	PAFZZ	5305-00-269-3213	15434	S103D	.SCREW,CAP,HEXAGON H...............................	EA	2
14	26	PAFZZ	5310-00-684-3463	96906	MS51092-1	.WASHER,FLAT.......................................	EA	2
14	27	PAFZZ	5330-01-069-1472	15434	3032348	.GASKET PART OF KIT P/N 3801350....................	EA	1
14	28	PAFZZ	4730-00-604-7953	72582	5111798	.PLUG,PIPE...	EA	1
14	29	XDFZZ		15434	217372	.HOUSING AFTERCOOLER...............................	EA	1

(1) ILLUSTRATION (a) FIG. NO.	(1) ILLUSTRATION (b) ITEM NO.	(2) SMR CODE	(3) NATIONAL STOCK NUMBER	(4) FSCM	(5) PART NUMBER	(6) DESCRIPTION USABLE ON CODE	(7) U/M	(8) QTY INC IN UNIT
						0108(CONT)		
14	30	XDFZZ		15434	214836	.CORE AFTERCOOLER................................	EA	1
14	31	PCFZZ	4720-01-085-6131	15434	155789	HOSE,WATER TRANSFER INLET..........................	EA	2
14	32	PAFZZ	5330-00-003-1771	15434	S684	WASHER,FLAT..	EA	2
14	33	PAFZZ	5305-00-269-3211	96906	MS90725-60	SCREW,CAP,HEXAGON H OUTLET PIPE TO BRACE...........	EA	1
14	34	PAFZZ	5310-00-159-6209	96906	MS122032	WASHER...	EA	2
14	35	XDFZZ		15434	217933	PIPE,WATER TRANSFER OUTLET.........................	EA	1
14	36	XDFZZ		15434	S145C	SCREW,CAP,HEXHEAD CONNECTOR TO BLOCK...............	EA	3
14	37	XDFZZ		15434	217932	CONNECTOR WATER OUTLET.............................	EA	1
14	38	PAFZZ	5330-01-082-6984	15434	215045	GASKET PART OF KIT P/N 3018762.....................	EA	1
14	39	XDFZZ		15434	215587	ADAPTER,WATER......................................	EA	1
14	40	PAFZZ	5310-00-521-8595	15434	S223	NUT,PLAIN,HEXAGON OUTLET PIPE TO BRACE.............	EA	1
14	41	XDFZZ		15434	217934	BRACE,WATER..	EA	1
14	42	PAFZZ	5310-00-232-8194	15434	S603	WASHER,LOCK BRACE TO ENGINE BLOCK..................	EA	1
14	43	XDFZZ		15434	S186A	SCREW,CAP,HEXAGON H................................	EA	1
14	44	PAFZZ	5340-00-087-7486	15434	107460	CLAMP,LOOP OUTLET PIPE TO BRACE....................	EA	1
14	45	PAFZZ	5330-01-086-3523	15434	3008591	GASKET PART OF KIT P/N 3801350.....................	EA	3

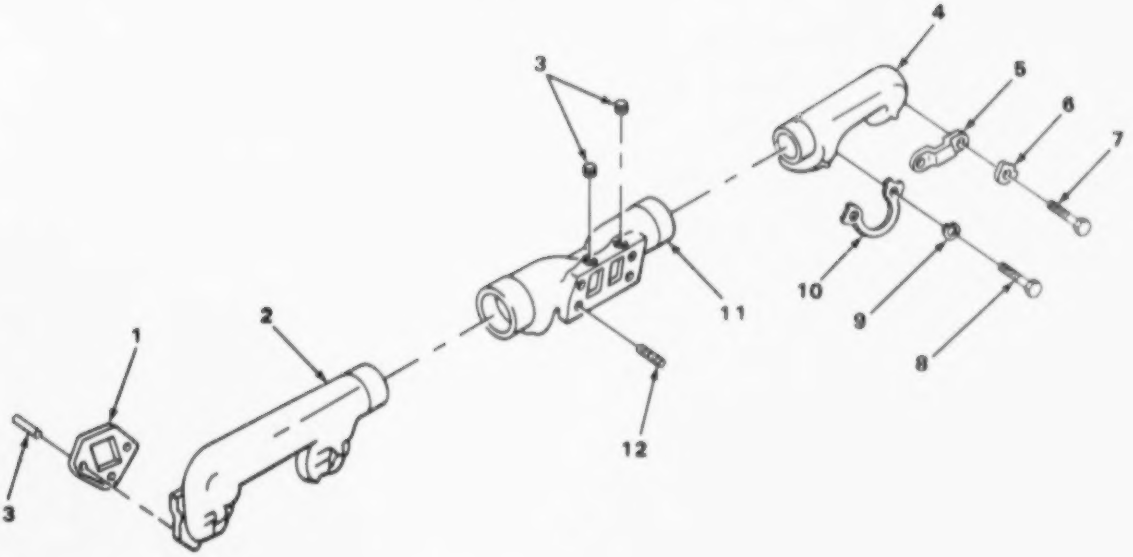
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FIGURE 15. EXHAUST MANIFOLD.

(1) ILLUSTRATION		(2) SMR CODE	(3) NATIONAL STOCK NUMBER	(4) FSCM	(5) PART NUMBER	(6) DESCRIPTION USABLE ON CODE	(7) U/M	(8) QTY INC IN UNIT
(a) FIG. NO.	(b) ITEM NO.							
						0108(CONT)		
15	1	PAFZZ	5330-00-659-3178	15434	3020943	GASKET PART OF KIT P/N 3801350	EA	6
15	2	PAFZZ	2815-00-920-8356	15434	151489	MANIFOLD,EXHAUST REAR CYLINDER HEAD MOUNTED	EA	1
15	3	PAFZZ	4730-01-085-7328	15434	217632	PLUG,PIPE EXHAUST MANIFOLD MOUNTED	EA	2
15	4	PAFZZ	2815-00-920-2073	15434	151478	MANIFOLD,EXHAUST FRONT CYLINDER HEAD MOUNTED	EA	1
15	5	PAFZZ	5340-00-132-3203	15434	200919	CLAMP,MANIFOLD EXHAUST MANIFOLD MOUNTING	EA	2
15	6	PAFZZ	5310-00-887-8325	15434	114638	LOCKING PLATE,NUT	EA	4
15	7	PAFZZ	5305-00-477-0395	15434	110266	SCREW,CAP,HEXAGON H MANIFOLD MOUNTING	EA	4
15	8	PAFZZ	5305-01-028-8869	15434	S155	SCREW,CAP,HEXAGON H EXHAUST MANIFOLD MOUNTING	EA	8
15	9	PAFZZ	3120-01-079-6527	15434	109594	WASHER,LOCK EXHAUST MANIFOLD TO CYLINDER HEAD EXHAUST PORTS	EA	8
15	10	PAFZZ	2815-00-767-4012	15434	116982	LOCKPLATE EXHAUST MANIFOLD MOUNTING PART OF KIT P/N 3801350	EA	4
15	11	PAFZZ	2815-01-077-4463	15434	200566	MANIFOLD,EXHAUST	EA	1
15	12	PAFZZ	5307-00-922-2626	15434	3006289	STUD,PLAIN	EA	4
15	13	PAFZZ	2815-00-829-5227	15434	105199	PIN,DOWEL STRAIGHT,HEADLESS,EXHAUST MANIFOLD MOUNTING	EA	6

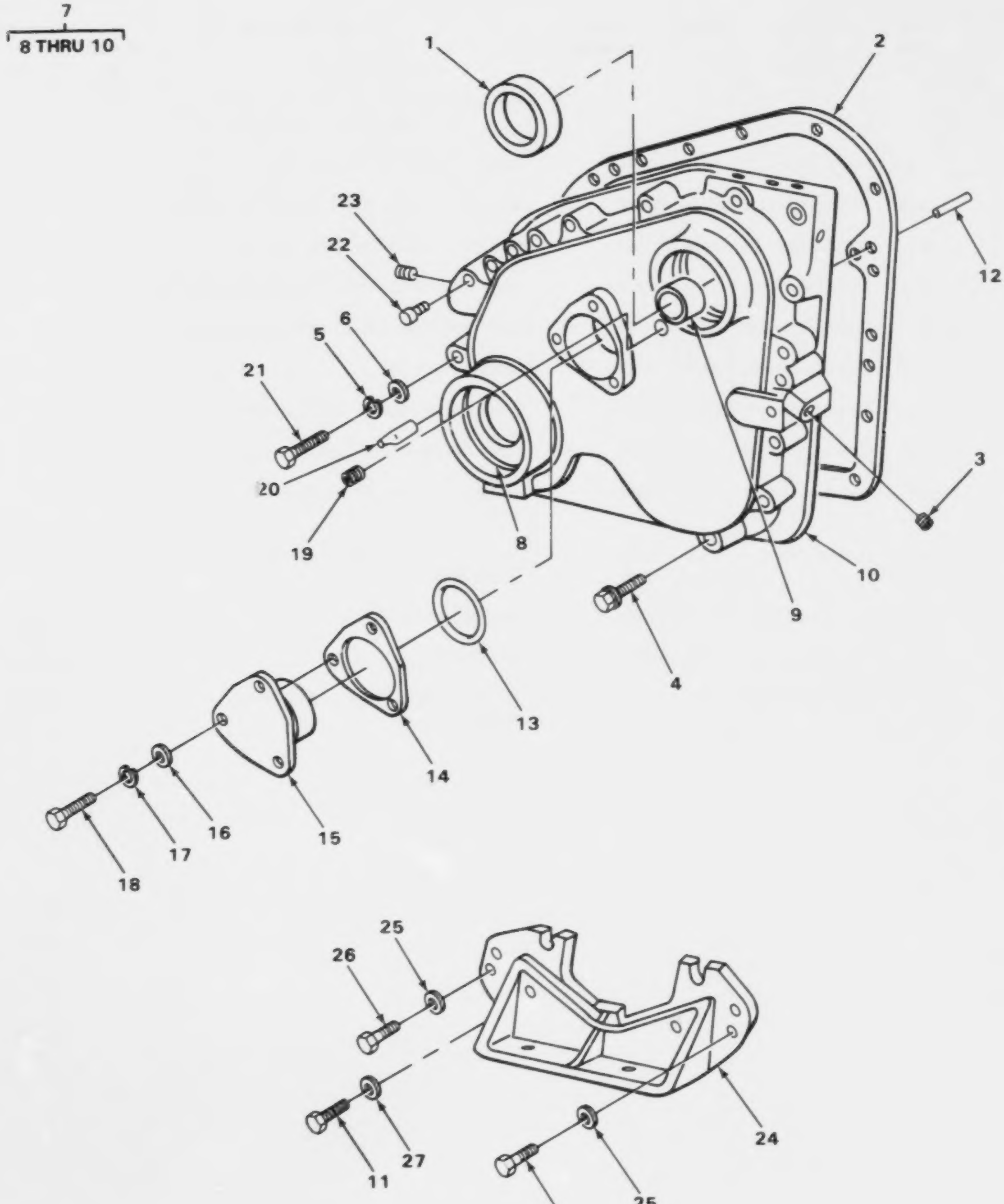
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FIGURE 16. GEAR COVER ASSEMBLY.

(1) ILLUSTRATION (a) FIG. NO.	(1) ILLUSTRATION (b) ITEM NO.	(2) SMR CODE	(3) NATIONAL STOCK NUMBER	(4) FSCM	(5) PART NUMBER	(6) DESCRIPTION USABLE ON CODE	(7) U/M	(8) QTY INC IN UNIT
						0109-ACCESSORY DRIVING MECHANISMS		
16	1	PAFZZ	5330-00-005-0857	15434	3004316	SEAL,OIL	EA	1
16	2	PAFZZ	5330-01-046-0441	15434	3021705	GASKET PART OF KIT P/N 3018762	EA	1
16	3	PAFZZ	4730-00-010-3867	96906	MS51884-5	PLUG,PIPE 3/8 NPT	EA	1
16	4	XDFZZ		15434	3011711	SCREW ASSEMBLED WAS GEAR COVER ASSEMMBLY TO BLOCK	EA	10
16	5	PAFZZ	5310-00-209-0965	15434	S610	WASHER,LOCK GEAR COVER ASSEMBLY TO BLOCK	EA	1
16	6	PAFZZ	5310-00-562-6557	15434	S622	WASHER,PLAIN GEAR COVER ASSEMBLY TO BLOCK	EA	1
16	7	PAFFF	2815-01-092-9817	15434	AR9743	COVER ASSEMBLY GEAR CASE	EA	1
16	8	PAFZZ	5330-01-145-7550	15434	3006736	.SEAL,OIL CRANKSHAFT	EA	1
16	9	PAFZZ	3120-00-877-2213	15434	132770	.BUSHING	EA	1
16	10	XAFZZ		15434	210713	.COVER,GEAR	EA	1
16	11	XDFZZ		15434	212754	SCREW,CAP 12 POINT,ENGINE SUPPORT TO ENGINE	EA	2
16	12	PAFZZ	5315-00-238-0882	15434	60408	PIN,DOWEL	EA	1
16	13	PCFZZ	5330-01-086-7257	15434	215705	PACKING,PREFORMED PART OF KIT P/N 3018762	EA	1
16	14	PAFZZ	5365-00-507-3254	15434	65259C	SHIM .002 INCH	EA	V
16	14	PAFZZ	5365-00-361-2953	15434	65259A	SHIM .010 INCH	EA	V
16	14	PAFZZ	5365-01-086-7788	15434	185573	SHIM INSERT	EA	1
16	14	PAFZZ	5365-00-361-2953	15434	65259B	SHIM .005 INCH	EA	V
16	15	XDFZZ		34623	MA207-22712	SUPPORT CAMSHAFT	EA	1
16	16	PAFZZ	5310-00-080-6004	96906	MS27183-14	WASHER,FLAT	EA	3
16	17	PAFZZ	5310-00-637-9541	96906	MS35338-46	WASHER,LOCK	EA	3
16	18	PAFZZ	5305-00-269-3213	15434	S103D	SCREW,CAP,HEXAGON H CAMSHAFT SUPPORT TO GEAR CASE COVER	EA	3
16	19	PAFZZ	4730-00-042-8988	55883	IPD7H3171	PLUG,PIPE	EA	1
16	20	PAFZZ	2815-00-772-9434	15434	70653	PIN,DOWEL	EA	1
16	21	XDFZZ		15434	S119C	SCREW,CAP,HEXAGON H GEAR COVER ASSEMBLY TO BLOCK	EA	1
16	22	XDFZZ		15434	3011713	SCREW ASSEMBLED WAS GEAR COVER ASSEMBLY TO BLOCK	EA	1
16	23	PAFZZ	5365-00-716-6580	15434	68606	PLUG,PIPE	EA	1
16	24	PAFZZ	2815-01-079-9146	15434	214306	SUPPORT,ENGINE FRONT	EA	1
16	25	XDFZZ		15434	3000082	WASHER,PLAIN ENGINE SUPPORT TO ENGINE	EA	4

(1) ILLUSTRATION (a) FIG. NO.	(1) ILLUSTRATION (b) ITEM NO.	(2) SMR CODE	(3) NATIONAL STOCK NUMBER	(4) FSCM	(5) PART NUMBER	(6) DESCRIPTION USABLE ON CODE	(7) U/M	(8) QTY INC IN UNIT
						0109(CONT)		
16	26	XDFZZ		15434	213456	SCREW,CAP,HEXAGON H ENGINE SUPPORT TO ENGINE.......	EA	6
16	27	PBFZZ	5310-01-112-4306	15434	203760	WASHER,PLAIN ENGINE SUPPORT TO ENGINE..............	EA	2

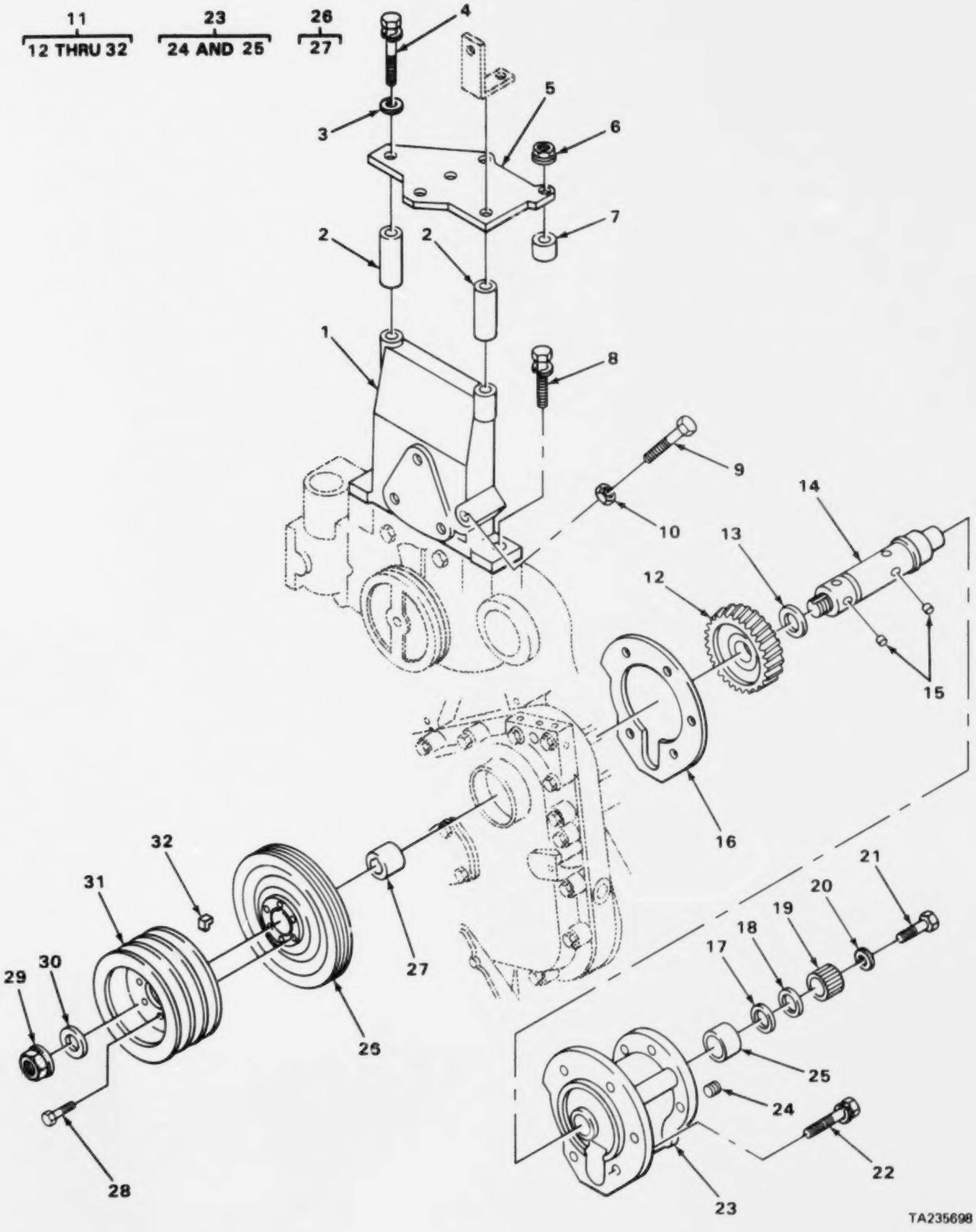
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FIGURE 17. ACCESSORY DRIVE PULLEY AND FAN CLUTCH MOUNTING.

REPAIR PARTS LIST

(1) ILLUSTRATION (a) FIG. NO.	(1) ILLUSTRATION (b) ITEM NO.	(2) SMR CODE	(3) NATIONAL STOCK NUMBER	(4) FSCM	(5) PART NUMBER	(6) DESCRIPTION USABLE ON CODE	(7) U/M	(8) QTY INC IN UNIT
						0109-ACCESSORY DRIVING MECHANISMS		
17	1	PBOZZ	2930-01-098-0175	15434	208829	BRACKET,FAN SUPPORT	EA	1
17	2	PAOZZ	5365-01-095-5666	75078	003251	SPACER,SLEEVE FAN BRACE	EA	2
17	3	PAOZZ	5310-01-145-8405	75078	001030	WASHER,FLAT	EA	2
17	4	PAOZZ	5305-01-145-8382	75078	003252	SCREW,CAP,HEXAGON H WITH CAPTIVE WASHER	EA	2
17	5	PAOZZ	2930-01-097-6755	15434	217034	BRACE,FAN BRACKET	EA	1
17	6	PAOZZ	5310-01-144-6115	75078	001094	NUT,PLAIN,CONE SEAT	EA	2
17	7	PAOZZ	5365-01-147-5030	75078	001234	SPACER,SLEEVE	EA	2
17	8	PAOZZ	5305-01-145-0776	15434	3019574	SCREW,CAP,HEXAGON H WITH CAPTIVE WASHER	EA	2
17	9	PAOZZ	5305-01-091-2498	15434	166777	SCREW	EA	1
17	10	PAOZZ	5310-00-470-6154	15434	S285	NUT,PLAIN,HEXAGON	EA	1
17	11	PAFFF	4310-01-092-9815	15434	3005133	ACCESSORY DRIVE,COM	EA	1
17	12	PAFZZ	3020-00-160-9092	15434	142689	.GEAR,HELICAL ACCESSORY DRIVE	EA	1
17	13	PAFZZ	3120-01-147-5275	15434	3026556	.BEARING,WASHER,THRU	EA	1
17	14	PAFZZ	4310-01-092-9816	15434	3000171	.SHAFT,AIR COMPRESSO ACCESSORY DRIVE	EA	1
17	15	PAFZZ	2815-01-124-0232	15434	70550	.PIN,PISTON	EA	2
17	16	PAFZZ	5330-00-026-2931	15434	200809	.GASKET PART OF KIT P/N 3018762	EA	1
17	17	PAFZZ	5310-01-144-7368	15434	3026557	.BEARING,WASHER,THRU	EA	1
17	18	PAFZZ	5310-00-081-9292	15434	116390	.WASHER,FLAT	EA	1
17	19	PAFZZ	3040-01-085-2732	15434	3000174	.COUPLING HALF,SHAFT	EA	1
17	20	PAFZZ	5310-00-486-2507	15434	170664	.WASHER,FLAT	EA	1
17	21	PAFZZ	5306-01-119-4271	15434	3000173	.BOLT,INTERNALLY REL	EA	1
17	22	PAFZZ	5305-01-119-8621	15434	3010590	.SCREW WITH CAPTIVE WASHER	EA	5
17	23	PAFFF	2990-01-129-4302	15434	AR-45724	.HOUSING,MECHANICAL ACCESSORY DRIVE	EA	1
17	24	PAFZZ	4730-00-018-9566	15434	S911B	..PLUG,PIPE	EA	2
17	25	PAFZZ	3120-00-792-9834	15434	116391	..BEARING,SLEEVE	EA	1
17	26	PAFFF	3020-01-146-3163	15434	3023473	.PULLEY,FLAT ACCESSORY DRIVE	EA	1
17	27	PAFZZ	2930-00-401-9531	15434	190397	.SLEEVE,PULLEY PUMP	EA	1
17	28	PAFZZ	5305-01-145-8383	15434	175833	.SCREW,CAP,HEXAGON H	EA	6
17	29	PAFZZ	5310-01-126-1045	15434	3012526	.NUT,SELF-LOCKING,HE	EA	1

(1) ILLUSTRATION		(2) SMR CODE	(3) NATIONAL STOCK NUMBER	(4) FSCM	(5) PART NUMBER	(6) DESCRIPTION USABLE ON CODE	(7) U/M	(8) QTY INC IN UNIT
(a) FIG. NO.	(b) ITEM NO.							
						0109(CONT)		
17	30	PAFZZ	5310-01-124-6463	15434	193136	.WASHER,FLAT......................................	EA	1
17	31	PAFZZ	3020-01-146-3773	15434	3013336	.PULLEY,CONE ACCESSORY DRIVE......................	EA	1
17	32	PCFZZ	5330-01-129-6541	15434	3008947	.RUBBER STRIP.....................................	EA	1

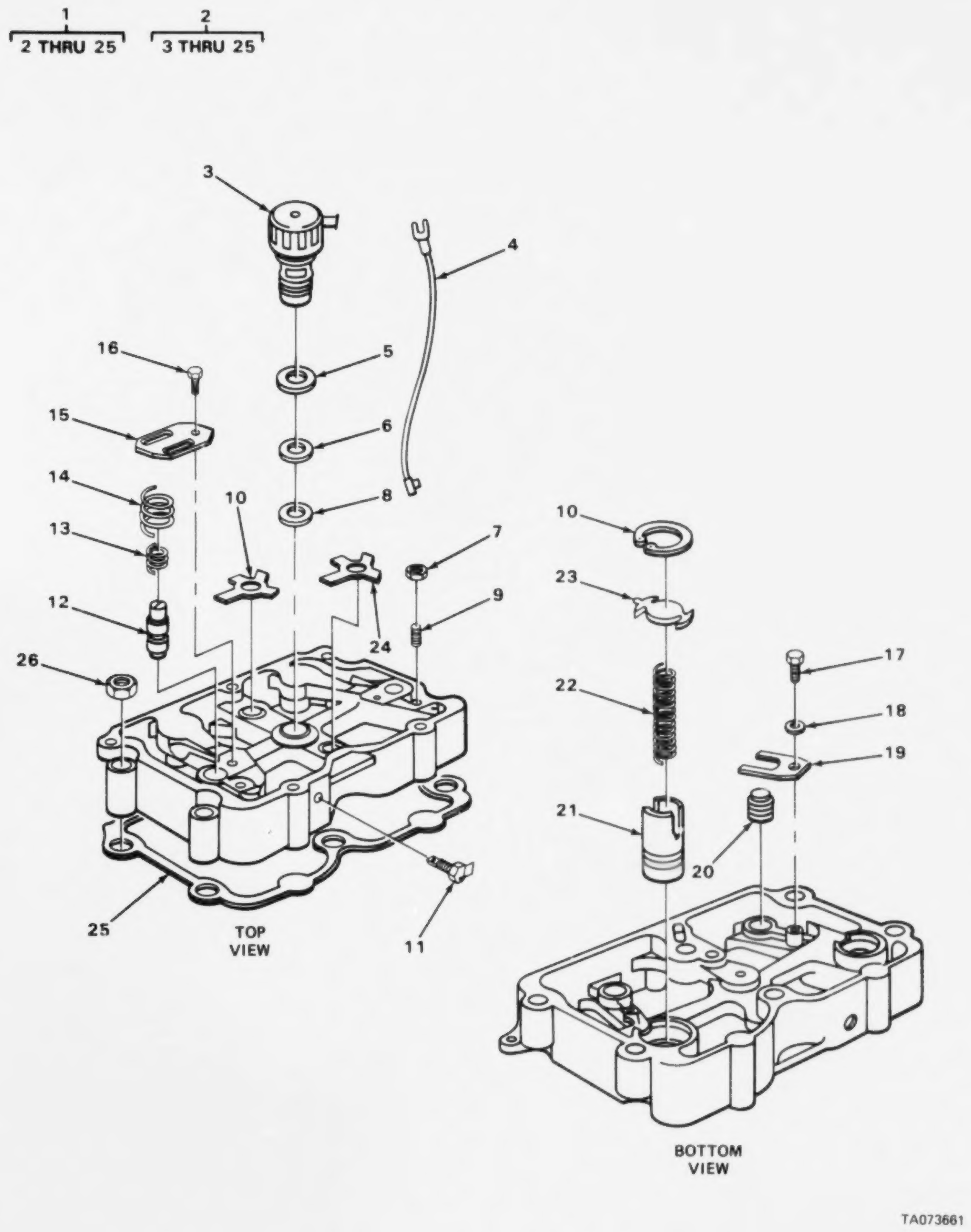
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FIGURE 18. ENGINE RETARDER.

(1) ILLUS-TRATION (a) FIG. NO.	(1) ILLUS-TRATION (b) ITEM NO.	(2) SMR CODE	(3) NATIONAL STOCK NUMBER	(4) FSCM	(5) PART NUMBER	(6) DESCRIPTION	(6) USABLE ON CODE	(7) U/M	(8) QTY INC IN UNIT
						0112-ENGINE BRAKE			
18	1	PAFHH	2815-01-085-2574	75078	006999	RETARDER,ENGINE		EA	3
18	2	XDHHH		75078	005342	.HOUSING ASSEMBLY ROCKER HOUSING MOUNTED		EA	1
18	3	PAHZZ	4810-01-089-0534	75078	004205	..VALVE ASSEMBLY SOLENOID,BRAKE HOUSING TO ROCKER HOUSING		EA	1
18	4	PAHZZ	6140-01-114-7119	75078	002390	..HARNESS,SOLENOID VALVE ASSEMBLY MOUNTED		EA	1
18	5	PCHZZ	5330-01-086-1013	75078	001081	..PACKING,PREFORMED UPPER SOLENOID VALVE ASSEMBLY		EA	1
18	6	PCFZZ	5330-01-085-3105	75078	001082	..PACKING,PREFORMED CENTER SOLENOID VALVE ASSEMBLY		EA	1
18	7	PAHZZ		75078	001026	..NUT,PLAIN HEXAGON 0.375-24		EA	2
18	8	PCHZZ	5330-01-086-6196	75078	001083	..PACKING,PREFORMED LOWER SOLENOID VALVE ASSEMBLY		EA	1
18	9	PAFZZ		75078	001031	..SETSCREW BRAKE HOUSING TO ROCKER HOUSING 0.375-24 X 0.75 INCH LONG		EA	2
18	10	PAHZZ	5365-01-087-8727	75078	001023	..RING,RETAINING SLAVE PISTON SPRING RETAINER TO ROCKER HOUSING		EA	2
18	11	PAHZZ	5940-01-085-4426	75078	002299	..TERMINAL ASSEMBLY BRAKE HOUSING MOUNTED		EA	1
18	12	PAHZZ	4820-01-089-3939	75078	001521	..SPOOL ASSEMBLY CONTROL VALVE COVER TO SLAVE PISTON		EA	2
18	13	PAHZZ	5360-01-089-1367	75078	007500	..SPRING,HELICAL		EA	2
18	14	PAHZZ	5360-01-089-9103	75078	001519	..SPRING,HELICAL		EA	2
18	15	XDHZZ		75078	004136	..COVER,VALVE CONTROL ENGINE BRAKE HOUSING MOUNTING		EA	2
18	16	XDHZZ		75078	001265	..CAPSCREW,HEX CONTROL VALVE COVER TO HOUSING		EA	2
18	17	XDHZZ		75078	001492	..SCREW,CAP,HEXAGON H BRAKE HOUSING MOUNTED		EA	2
18	18	XDHZZ		75078	001030	..WASHER CAPSCREW TO FLAT WASHER		EA	2
18	19	PAHZZ		75078	007447	..SPRING,FLAT		EA	2
18	20	PAHZZ	2815-01-088-7328	75078	004089	..PISTON,MASTER BRAKE HOUSING MOUNTED		EA	2
18	21	PAHZZ	2815-01-098-6755	75078	007623	..PISTON,SLAVE PISTON SPRING RETAINER TO BRAKE HOUSING		EA	2
18	22	PAHZZ	5360-01-084-9066	75078	001022	..SPRING,HELICAL		EA	2
18	23	PAHZZ	5340-01-085-4439	75078	008895	..RETAINER PISTON SPRING		EA	2
18	24	PAFZZ	5310-01-086-3948	75078	002680	LOCKPLATE ENGINE BRAKE HOUSING MOUNTED		EA	6
18	25	PAFZZ	5330-01-086-3996	75078	10279	GASKET ENGINE BRAKE HOUSING TO ROCKER HOUSING		EA	1
18	26	PAFZZ	5310-01-144-6115	75078	001094	NUT,PLAIN,HEXAGON		EA	18

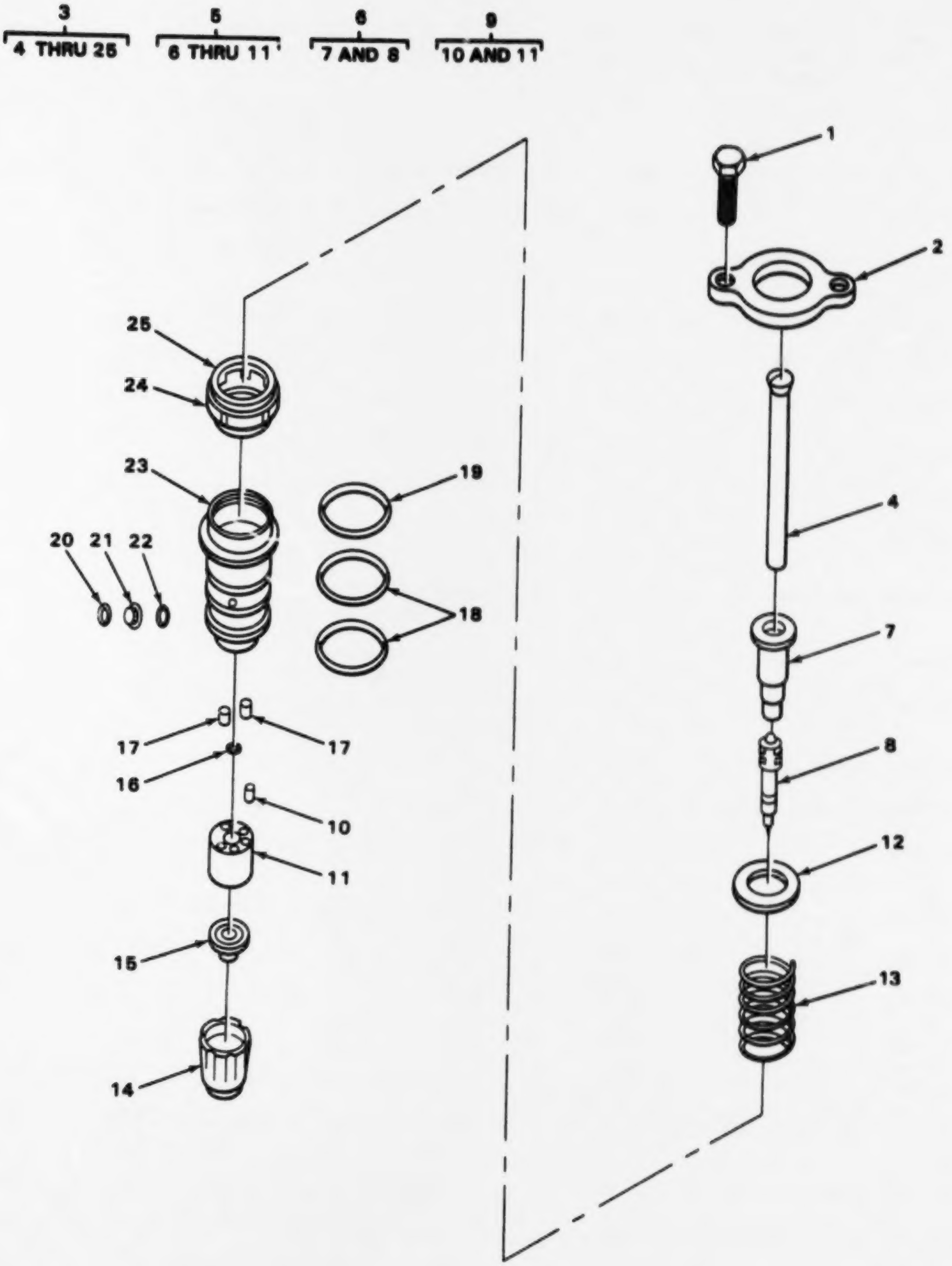
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FIGURE 19. FUEL INJECTOR ASSEMBLY.

(1) ILLUS-TRATION		(2)	(3)	(4)	(5)	(6)	(7)	(8)
(a) FIG. NO.	(b) ITEM NO.	SMR CODE	NATIONAL STOCK NUMBER	FSCM	PART NUMBER	DESCRIPTION USABLE ON CODE	U/M	QTY INC IN UNIT
						GROUP 03–FUEL SYSTEM 0301–FUEL INJECTOR		
19	1	PAFZZ	5305-01-086-7285	15434	202069	SCREW,CAP,HEXAGON H	EA	2
19	2	PAFZZ	2910-01-077-4976	15434	3003682	CLAMP,INJECTOR FUEL INJECTOR MOUNTING	EA	1
19	3	PAFHH	2910-01-112-7712	15434	3018346	INJECTOR ASSEMBLY FUEL,DIESEL CYLINDER HEAD MOUNTED	EA	6
19	4	PAFZZ	2910-00-238-5435	15434	191916	.LINK,INJECTOR PLUNGER,FUEL INJECTOR BARREL AND PLUNGER TO INJECTOR CLAMP	EA	1
19	5	PAHHH	2910-01-077-7303	15434	3022968	.BARREL AND PLUNGER FUEL INJECTOR SPINDLE TO INJECTOR SPRING	EA	1
19	6	XAHHH		15434	3009470	..PLUNGER AND COUPLIN INJECTOR	EA	1
19	7	XAHZZ		15434	3000463	...COUPLING,INJECTOR	EA	1
19	8	XDHZZ		15434	3009468	...PLUNGER,INJECTOR	EA	1
19	9	XAHHH		15434	3009566	..BARREL AND PLUG	EA	1
19	10	XDHZZ		15434	189848	...PLUG,INJECTOR BARREL	EA	4
19	11	XAHZZ		15434	3009469	...BARREL,INJECTOR	EA	1
19	12	PAHZZ	5310-01-079-6529	15434	208525	.WASHER,FLAT FUEL INJECTOR SPINDLE TO INJECTOR	EA	1
19	13	PAHZZ	5360-00-132-0245	15434	166009	.SPRING,HELICAL COMPRESSION,WASHER TO TOP STOP LOCKNUT	EA	1
19	14	PAHZZ	5340-01-079-4678	15434	185138	.RETAINER,CUP INJECTOR PLUNGER BARREL MOUNTED	EA	1
19	15	PAHZZ	2910-01-086-3974	15434	3012538	.CUP,INJECTOR,FUEL INJECTOR RETAINER CUP TO INJECTOR PLUNGER BARREL	EA	1
19	16	PAHZZ	2910-01-070-0710	15434	167157	.BALL,CHECK INJECTOR BARREL TO TOP STOP ADAPTER	EA	1
19	17	PAHZZ	5306-01-079-6506	15434	203426	.PIN,SCREW INJECTOR,TOP STOP ADAPTER MOUNTED	EA	2
19	18	PAHZZ	5330-00-132-0276	15434	193736	.GASKET FUEL INJECTOR TO COMBUSTION CHAMBER	EA	2
19	19	PCHZZ	5330-00-924-7757	96906	MS9241-024	.PACKING,PREFORMED PART OF KIT P/N 3801350	EA	1
19	20	PAHZZ	5365-00-815-1137	15434	174299	.RING,RETAINING	EA	1
19	21	PAHZZ	2910-01-077-2016	15434	3008706	.STRAINER,ELEMENT SEDIMENT	EA	1
19	22	PAHZZ	5330-00-132-0247	15434	173086	.GASKET	EA	1
19	23	PAHZZ	2910-01-076-8632	15434	3000464	.ADAPTER,TOP STOP,LOCKNUT TO INJECTOR CUP	EA	1
19	24	PAHZZ	5310-01-079-6708	15434	3000465	.NUT,LOCK TOP STOP ADAPTER TO INJECTOR SPRING	EA	1
19	25	PAHZZ	5305-01-079-7028	15434	212954	.SCREW,CAP,SOCKET	EA	1

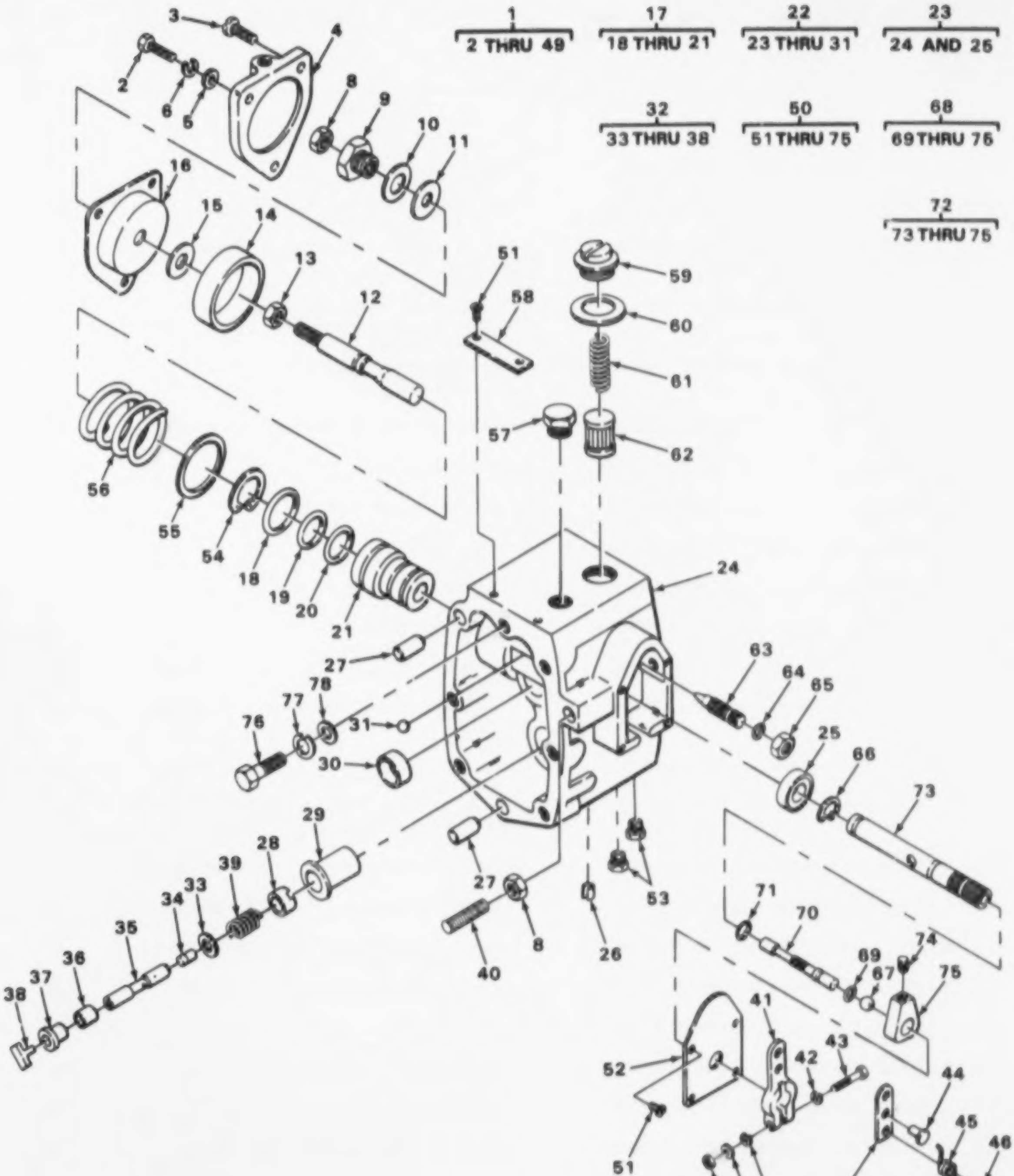
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FIGURE 20. FUEL PUMP MAIN HOUSING.

(1) ILLUSTRATION (a) FIG. NO.	(1) ILLUSTRATION (b) ITEM NO.	(2) SMR CODE	(3) NATIONAL STOCK NUMBER	(4) FSCM	(5) PART NUMBER	(6) DESCRIPTION USABLE ON CODE	(7) U/M	(8) QTY INC IN UNIT
						0302-FUEL PUMP		
20	1	PAHHH	3040-00-449-7397	15434	3024165	LEVER THROTTLE CONTROL............................	EA	1
20	2	PAHZZ	5305-00-018-6494	15434	S168C	.SCREW,CAP,HEXAGON H COVER TO HOUSING..............	EA	1
20	3	PAHZZ	5305-00-477-6769	15434	70772	.SCREW,CROSS TIP COVER TO DIAPHRAGM................	EA	3
20	4	XDHZZ		15434	3015520	.COVER FUEL CONTROL................................	EA	1
20	5	PAHZZ	5310-00-141-1795	88044	AN960-416	.WASHER,FLAT COVER TO HOUSING......................	EA	1
20	6	PAHZZ	5310-00-410-6756	15434	S606	.WASHER,LOCK COVER TO HOUSING......................	EA	1
20	8	PAHZZ	5310-00-971-7989	96906	MS35691-5	.NUT,PLAIN,HEXAGON.................................	EA	1
20	9	PAHZZ	2910-01-141-4029	15434	3023171	.SCREW,CAP,HEXAGON H...............................	EA	2
20	10	PCHZZ	5330-01-142-2784	15434	3023870	.GASKET PART OF KIT P/N 3010242...................	EA	1
20	11	PAHZZ	5310-01-145-0761	15434	214150	.WASHER FLAT DIAPHRAGM.............................	EA	1
20	12	PAHZZ	2910-01-086-1679	15434	3021676	.PLUNGER,GOVERNOR..................................	EA	1
20	13	XDHZZ		15434	S253	.NUT,PLAIN,HEXAGON.................................	EA	1
20	14	PAHZZ	2910-01-142-7455	15434	3013810	.PISTON AIR FUEL CONTROL...........................	EA	1
20	15	PAHZZ	5310-01-142-2812	15434	3023088	.WASHER PISTON RETAINING...........................	EA	1
20	16	PCHZZ	2910-01-079-3320	15434	3013811	.DIAPHRAGM...	EA	1
20	17	PAHHH	2910-01-164-2523	15434	3021462	.BARREL,AIR FUEL CONTROL...........................	EA	1
20	18	PCHZZ	5330-01-072-8982	15434	145505	..PACKING,PREFORMED PART OF KIT P/N 3010242........	EA	1
20	19	PCHZZ	5330-01-051-4243	15434	145504	..PACKING,PREFORMED PART OF KIT P/N 3010242........	EA	1
20	20	PCHZZ	5330-00-403-9896	15434	193734	..PACKING,PREFORMED PART OF KIT P/N 3010242........	EA	1
20	21	PAHZZ	2910-01-086-1651	15434	214146	..CYLINDER,ACTUATING...............................	EA	1
20	22	PBHHH	2910-01-086-3983	15434	AR41022	.HOUSING FUEL PUMP.................................	EA	1
20	23	PAHHH	2910-01-098-5094	15434	AR41021	..HOUSING FUEL PUMP................................	EA	1
20	24	XAHZZ		15434	217795	...BODY FUEL PUMP..................................	EA	1
20	25	PAHZZ	3120-01-080-3275	15434	209760	...BUSHING THROTTLE SHAFT..........................	EA	1
20	26	PAHZZ	2910-00-400-5178	15434	163733	..CLIP GOVERNOR BARREL.............................	EA	1
20	27	PAHZZ	5315-00-014-1215	15434	118227	..DOWEL..	EA	1
20	28	XAHZZ		15434	3001847	..BARREL GOVERNOR..................................	EA	2
20	29	XDHZZ		15434	217798	..HOUSING SPRING PACKAGE...........................	EA	1
20							EA	1

(1) ILLUS-TRATION (a) FIG. NO.	(1) ILLUS-TRATION (b) ITEM NO.	(2) SMR CODE	(3) NATIONAL STOCK NUMBER	(4) FSCM	(5) PART NUMBER	(6) DESCRIPTION USABLE ON CODE	(7) U/M	(8) QTY INC IN UNIT
						0302(CONT)		
20	30	PAHZZ	3120-00-810-6032	15434	100193	..BUSHING TACHOMETER DRIVE GEAR	EA	1
20	31	XDHZZ		15434	214139	..BALL,PLUG AIR FUEL	EA	1
20	32	AHHHH		15434	AR40130	.PLUNGER GOVERNOR CONTROL ASSEMBLY	EA	1
20	33	PAHZZ	5365-00-507-3224	15434	101841	..SHIM 0.005 IN. BYPASS VALVE	EA	V
20	33	PAHZZ	5365-00-543-3744	15434	101843	..SHIM 0.020 IN. BYPASS VALVE	EA	V
20	33	PAHZZ	5365-00-507-3225	15434	101842	..SHIM 0.010 IN. BYPASS VALVE	EA	V
20	34	PAHZZ	2910-01-080-5570	15434	203350	..PLUNGER GOVERNOR CONTROL	EA	1
20	35	PAHZZ	5315-00-907-0711	15434	137372	..PIN PLUNGER DRIVE	EA	1
20	36	PAHZZ	2910-00-829-5604	15434	144302	..SPACER,GOVERNOR	EA	1
20	37	PAHZZ	3120-00-764-7090	15434	138905	..WASHER,THRUST	EA	1
20	38	PAHZZ	2990-00-772-1778	15434	70690	..DRIVE,PLUNGER	EA	1
20	39	PAHZZ	5360-01-086-6114	15434	138769	.SPRING,HELICAL	EA	1
20	40	PAHZZ	5305-00-550-4710	15434	109918	SCREW,SOCKET	EA	1
20	41	PAHZZ	3120-00-493-3913	15434	166485	.SWIVEL THROTTLE LEVER	EA	1
20	42	PAHZZ	5310-00-159-6209	96906	MS122032	.WASHER,LOCK	EA	2
20	43	PAHZZ	5305-00-493-3959	15434	S159-B	.SCREW,CAP,HEXAGON H	EA	1
20	44	PAHZZ	2910-00-410-2268	34623	MA207-21542	.STOP THROTTLE LEVER	EA	1
20	45	PAHZZ	5360-00-436-7340	15434	173717	.SPRING,HELICAL TORSION	EA	1
20	46	PAHZZ	3040-00-449-7397	15434	BM94851	.LINK THROTTLE LEVER	EA	1
20	47	XDHZZ		15434	173708	.LEVER,THROTTLE	EA	1
20	48	PAHZZ	2930-00-353-9164	15434	S2876	.WASHER,FLAT	EA	1
20	49	PAHZZ	5310-00-971-7989	96906	MS35691-5	.NUT,PLAIN,HEXAGON	EA	1
20	50	PAFHH	2910-01-065-3979	15434	3004188-3257	FUEL PUMP ASSEMBLY	EA	1
20	51	PAHZZ	5305-00-804-6318	15434	S2286	.SCREW	EA	6
20	52	XDHZZ		15434	3000446	.COVER THROTTLE SHAFT	EA	1
20	53	PAFZZ	4730-01-078-6364	15434	200635	.PLUG,PIPE	EA	2
20	54	PAHZZ	5365-01-079-7142	15434	3001704	.RING,RETAINING	EA	1
20	55	PAHZZ	5365-01-079-8373	15434	3001707	.SHIM AIR FUEL CONTROL	EA	V
20	56	PAHZZ	5360-01-086-6113	15434	179834	.SPRING,HELICAL COMPRESSION	EA	1

(1) ILLUSTRATION (a) FIG. NO.	(1) ILLUSTRATION (b) ITEM NO.	(2) SMR CODE	(3) NATIONAL STOCK NUMBER	(4) FSCM	(5) PART NUMBER	(6) DESCRIPTION USABLE ON CODE	(7) U/M	(8) QTY INC IN UNIT
						0302(CONT)		
20	57	PAFZZ	4730-00-042-8988	55883	IPD7H3171	.PLUG,PIPE	EA	1
20	58	PAHZZ	9905-00-733-7622	15434	105375	.PLATE,NAME	EA	1
20	59	PBOZZ	5365-00-507-3271	15434	157088	.PLUG,MACHINE FUEL PUMP	EA	1
20	60	PCOZZ	5330-00-961-9470	15434	154088	.SEAL,CAP	EA	1
20	61	PBOZZ	5360-00-597-4570	15434	70700	.SPRING,HELICAL	EA	1
20	62	PAOZZ	2910-00-790-8736	15434	146483	.FILTER ELEMENT	EA	1
20	63	PAHZZ	2910-01-091-7507	15434	214144	.VALVE,FUEL AIR MIXTURE	EA	1
20	64	PCHZZ	5330-00-132-0274	15434	190876	.PACKING,PREFORMED PART OF KIT P/N 3010242	EA	1
20	65	PAHZZ	5310-00-005-6052	15434	S248	.NUT,PLAIN,HEXAGON	EA	1
20	66	PAHZZ	5365-00-256-2846	96906	MS16632-1050	.RING,RETAINING	EA	1
20	67	PAHZZ	3110-01-079-8190	15434	213769	.PLUG,BALL	EA	1
20	68	PAHHH	2910-01-080-3149	15434	AR41010	.SHAFT ASSEMBLY THROTTLE	EA	1
20	69	PCHZZ	5330-01-072-8983	15434	213768	..O-RING PART OF KIT P/N 3010242	EA	1
20	70	PAHZZ	5305-01-072-8826	15434	3006175	..SCREW FUEL ADJUSTING	EA	1
20	71	PCHZZ	5330-00-081-9289	15434	100478	..PACKING,PREFORMED PART OF KIT P/N 3010242	EA	1
20	72	XDHHH		15434	3006430	..SHAFT THROTTLE ASY	EA	1
20	73	XAHZZ		15434	3006350	...SHAFT,THROTTLE RED 0.5010	EA	1
20	73	XAHZZ		15434	3006351	...SHAFT,THROTTLE BLUE 0.5012	EA	1
20	73	XAHZZ		15434	3006353	...SHAFT,THROTTLE GREEN 0.5015	EA	1
20	74	XDFZZ		15434	3006344	...SCREW,SET THROTTLE SHAFT MOUNTED	EA	1
20	75	PAHZZ	2910-01-086-1449	15434	3006343	...END,CONTROL ROD	EA	1
20	76	PAFZZ	5305-00-426-4142	15434	S105	SCREW,CAP	EA	6
20	77	PAFZZ	5310-00-484-1718	15434	181466	WASHER,LOCK	EA	6
20	78	PAFZZ	5310-00-041-1795	88044	AN960-416	WASHER,FLAT	EA	6

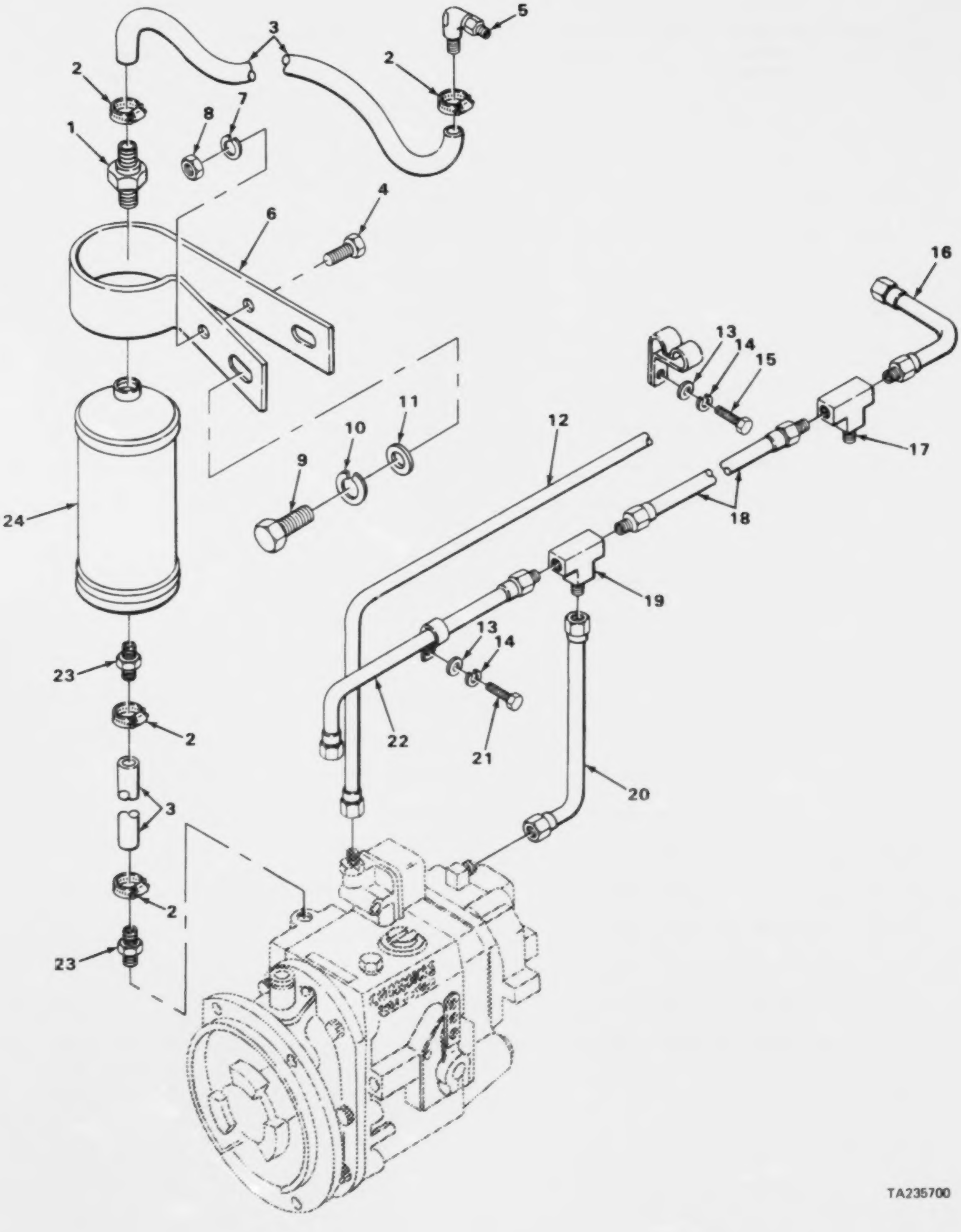
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FIGURE 21. FUEL LINES.

(1) ILLUSTRATION (a) FIG. NO.	(1) ILLUSTRATION (b) ITEM NO.	(2) SMR CODE	(3) NATIONAL STOCK NUMBER	(4) FSCM	(5) PART NUMBER	(6) DESCRIPTION USABLE ON CODE	(7) U/M	(8) QTY INC IN UNIT
						0302(CONT)		
21	1	KFOZZ		15434	3020754	BODY,CHECK VALVE PART OF KIT P/N 3021124	EA	1
21	2	PAOZZ	4730-00-278-9200	88044	AN737TW22	HOSE,CLAMP PART OF KIT P/N 3021124	EA	4
21	3	MOOZZ		19207	5414243-20	HOSE,NONMETALLIC MANUFACTURE FROM NSN 4720-00-541-4243 PART OF KIT P/N 3021124	EA	2
21	4	PAOZZ	5305-00-851-5992	15434	S109	SCREW,CAP,HEXAGON PART OF KIT P/N 3021124	EA	1
21	5	PAOZZ	4730-01-142-8524	15434	68139	FITTING,PIPE PART OF KIT P/N 3021124	EA	1
21	6	KFOZZ		15434	170970	CLAMP PART OF KIT P/N 3021124	EA	1
21	7	PAOZZ	5310-00-637-9541	96906	MS35338-46	WASHER,LOCK PART OF KIT P/N 3021124	EA	1
21	8	PAOZZ	5310-00-521-8595	15434	S223	NUT PART OF KIT P/N 3021124	EA	1
21	9	KFOZZ		15434	S-151C	SCREW,CAP,HEXAGON PART OF KIT P/N 3021124	EA	1
21	10	PAOZZ	5310-00-873-1153	15434	S609	WASHER,LOCK PART OF KIT P/N 3021124	EA	1
21	11	KFOZZ		15434	S689	WASHER,PLAIN PART OF KIT P/N 3021124	EA	1
21	12	PBOZZ	4710-01-079-3493	15434	216128	TUBE ASSEMBLY,METAL	EA	1
21	13	PAOZZ	5310-00-562-6560	15434	S631	WASHER,FLAT	EA	2
21	14	PAOZZ	5310-00-159-6209	96906	MS122032	WASHER,LOCK	EA	2
21	15	PAOZZ	5306-01-204-3297	15434	137796	SCREW,CAP,HEX HEAD	EA	1
21	16	PBOZZ	4710-01-106-8068	15434	3009848	TUBE ASSEMBLY,METAL	EA	1
21	17	PAOZZ	4730-01-146-3633	15434	3014398	TEE,TUBE	EA	1
21	18	PBOZZ	4710-01-085-6134	15434	3015393	TUBE ASSEMBLY,METAL	EA	1
21	19	PAOZZ	4730-01-109-8501	15434	3014397	TEE,TUBE	EA	1
21	20	PBOZZ	4710-01-085-9349	15434	3015375	TUBE ASSEMBLY,METAL	EA	1
21	21	PAOZZ	5305-01-081-0474	15434	S-156-B	SCREW,CAP,HEXAGON H	EA	1
21	22	PBOZZ	4710-01-085-9348	15434	3015373	TUBE ASSEMBLY,METAL	EA	1
21	23	PAOZZ	4730-00-900-3296	96906	MS39158-3	ADAPTER,STRAIGHT,PI PART OF KIT P/N 3021124	EA	2
21	24	KFOZZ		15434	3020753	TANK,AIR PART OF KIT P/N 3021124	EA	1
21		PAOZZ	4820-01-158-0555	15434	3021124	KIT,ATTENUATOR AIR SIGNAL	EA	1
21	1					BODY,CHECK VALVE	EA	1
21	2					HOSE,CLAMP	EA	4
21	3					HOSE,NONMETALLIC	EA	2
21	4					SCREW,CAP,HEXAGON	EA	1
21	5					FITTING,PIPE	EA	1
21	6					CLAMP	EA	1
21	7					WASHER,LOCK	EA	1

(1) ILLUSTRATION (a) FIG. NO.	(1) ILLUSTRATION (b) ITEM NO.	(2) SMR CODE	(3) NATIONAL STOCK NUMBER	(4) FSCM	(5) PART NUMBER	(6) DESCRIPTION USABLE ON CODE	(7) U/M	(8) QTY INC IN UNIT
						0302(CONT)		
21	8					NUT	EA	1
21	9					SCREW,CAP,HEXAGON	EA	1
21	10					WASHER,LOCK	EA	1
21	11					WASHER,PLAIN	EA	1
21	23					ADAPTER,STRAIGHT,PI	EA	2
21	24					TANK,AIR	EA	1

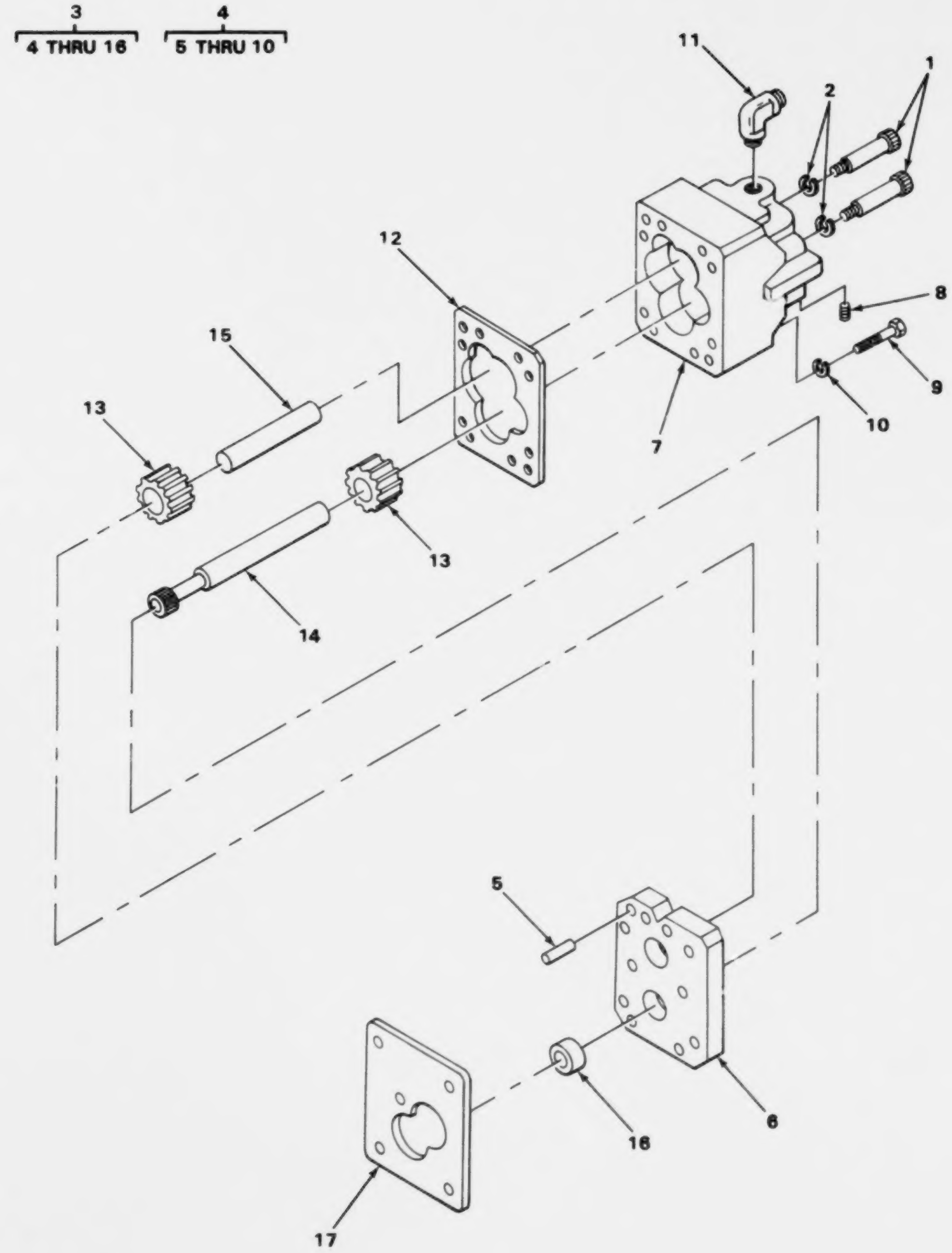
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FIGURE 22. FUEL GEAR PUMP.

(1) ILLUS-TRATION (a) FIG. NO.	(1) (b) ITEM NO.	(2) SMR CODE	(3) NATIONAL STOCK NUMBER	(4) FSCM	(5) PART NUMBER	(6) DESCRIPTION	USABLE ON CODE	(7) U/M	(8) QTY INC IN UNIT
						0302(CONT)			
22	1	PAFZZ	5305-00-721-3698	15434	100129	SCREW,CAP,HEXAGON H................................		EA	4
22	2	PAFZZ	5310-00-159-6209	96906	MS122032	WASHER,LOCK GEAR PUMP TO FUEL CONTROL..............		EA	4
22	3	PAFHH	2910-00-869-3428	15434	BM97502	PUMP,FUEL..		EA	1
22	4	PAHHH	2910-01-096-9200	15434	BM97497	.HOUSING AND COVER.................................		EA	1
22	5	PAHZZ	5315-00-014-1244	15434	64816A	..PIN,STRAIGHT,HEADLE COVER TO HOUSING............		EA	2
22	6	XAHZZ		15434	175867	..COVER,PUMP.......................................		EA	1
22	7	XAHZZ		15434	175860	..HOUSING,PUMP.....................................		EA	1
22	8	PAHZZ	5365-00-716-6580	15434	68606	..PLUG,PIPE GEAR PUMP HOUSING......................		EA	1
22	9	PAHZZ	5306-00-485-0790	15434	70790	..BOLT,MACHINE.....................................		EA	2
22	10	PAHZZ	5310-00-484-1718	15434	181466	..WASHER,LOCK COVER TO HOUSING.....................		EA	2
22	11	PAHZZ	4820-00-130-4820	15434	175836	.ELBOW FUEL INLET..................................		EA	1
22	12	PCHZZ	5330-00-567-3463	15434	110855	.GASKET PART OF KIT P/N 3010242....................		EA	1
22	13	PAHZZ	3020-00-702-3882	15434	119363	.GEAR,SPUR...		EA	2
22	14	PAHZZ	2910-00-567-4354	15434	100215	.SHAFT,DRIVE PUMP..................................		EA	1
22	15	PAHZZ	2910-00-933-3012	15434	175864	.SHAFT,IDLER GEAR PUMP.............................		EA	1
22	16	PAHZZ	3120-00-719-5719	15434	101486	.RING,DOWEL..		EA	1
22	17	PCFZZ	5330-00-006-2494	15434	210647	GASKET PART OF KIT P/N 3010242.....................		EA	1

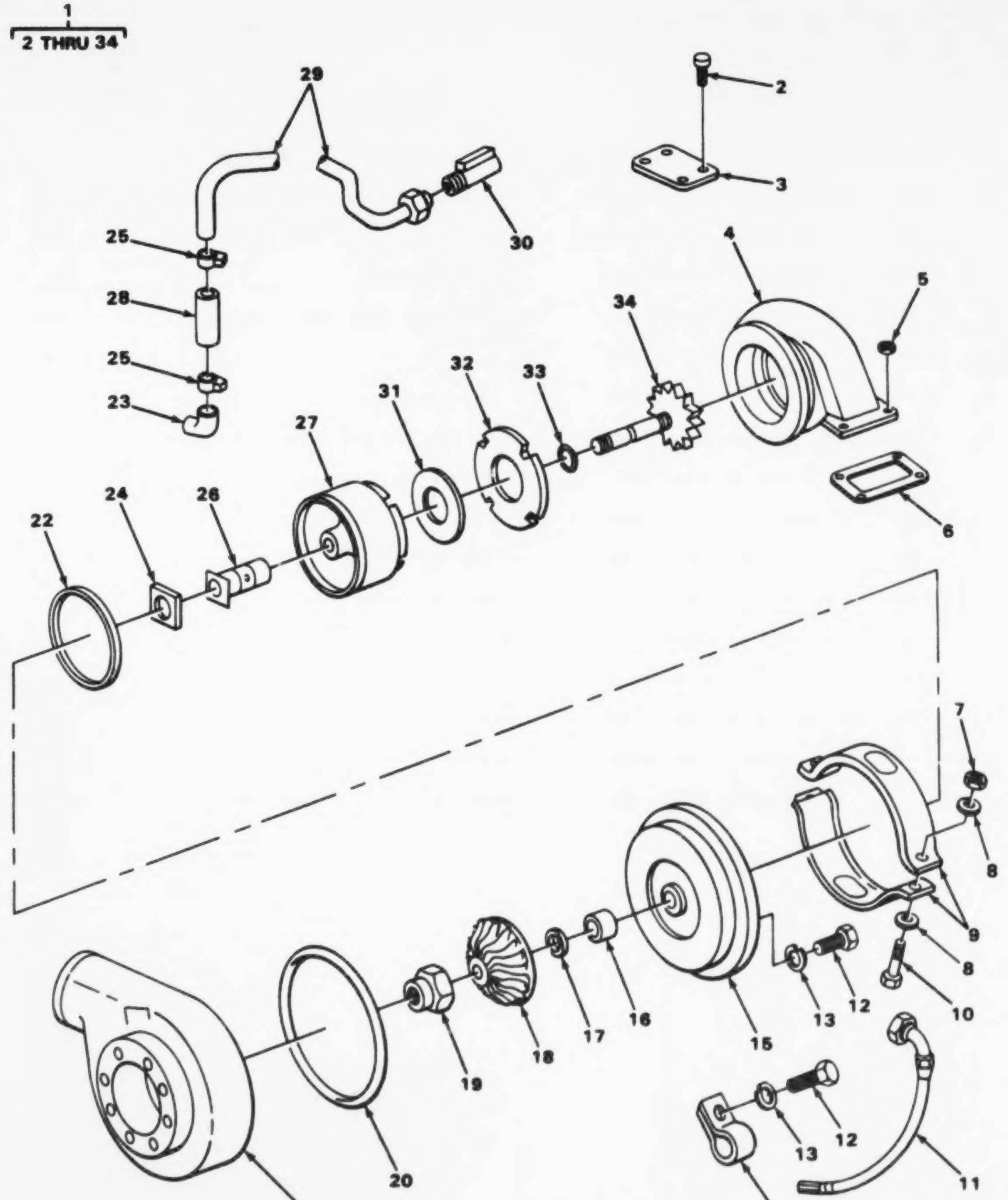
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FIGURE 23. TURBOCHARGER ASSEMBLY.

(1) ILLUS-TRATION (a) FIG. NO.	(1) ILLUS-TRATION (b) ITEM NO.	(2) SMR CODE	(3) NATIONAL STOCK NUMBER	(4) FSCM	(5) PART NUMBER	(6) DESCRIPTION USABLE ON CODE	(7) U/M	(8) QTY INC IN UNIT
						0305-SUPERCHARGER, BLOWER, TURBOCHARGE OR ALTITUDE COMPENSATOR		
23	1	PAFHH	2990-01-085-2572	15434	3032068	TURBOCHARGER ASSEMB T-50............................	EA	1
23	2	PAHZZ	5305-00-804-6318	15434	S2286	.SCREW,DRIVE PART OF KIT P/N 3003807...............	EA	4
23	3	PAHZZ	2815-00-406-6737	15434	128936	.PLATE,NAME,TURBO PART OF KIT P/N 3003807..........	EA	1
23	4	PAHZZ	2815-01-086-1448	15434	204244	.HOUSING TURBINE..................................	EA	1
23	5	PAFZZ	5310-01-073-2854	15434	219138	.NUT,HEX HEAD SELF-LOCKING.........................	EA	4
23	6	PAFZZ	5330-00-194-8385	15434	190849	.GASKET PART OF KIT P/N 3801350....................	EA	1
23	7	PAFZZ	5310-00-680-6874	15434	167299	.NUT,SELF-LOCKING V-BAND CLAMP.....................	EA	2
23	8	PAFZZ	5310-00-562-6560	15434	S631	.WASHER,PLAIN V-BAND CLAMP.........................	EA	4
23	9	PAFZZ	5340-00-103-9988	15434	156416	.CLAMP V-BAND......................................	EA	1
23	10	PAFZZ	5305-00-411-9340	15434	194010	.SCREW,CAP,HEXAGON H V-BAND........................	EA	2
23	11	PCHZZ	4720-01-085-6293	15434	215195	.HOSE OIL SUPPLY...................................	EA	1
23	12	PAHZZ	5305-00-230-1939	15434	S118A	.SCREW,CAP,HEXAGON H...............................	EA	8
23	13	PAHZZ	5310-00-159-6209	96906	MS122032	.WASHER,LOCK AIR DIFFUSER MOUNTING.................	EA	8
23	14	PAHZZ	4730-00-555-8263	53496	55611-2A	.CLAMP...	EA	2
23	15	PAHZZ	2990-01-085-1622	15434	217736	.PLATE DIFFUSER,AIR................................	EA	1
23	16	PAHZZ	2950-01-085-3580	15434	216802	.SEAL,OIL,SLEEVE PART OF KIT P/N 3003807...........	EA	1
23	17	PAHZZ	2950-00-275-8276	15434	211375	.RING,OIL SEAL PART OF KIT P/N 3003807.............	EA	1
23	18	PAHZZ	2990-01-085-2607	15434	3002731	.WHEEL,COMPRESSOR..................................	EA	1
23	19	PAFZZ	5310-00-164-1904	15434	S222A	.NUT,SELF-LOCKING TURBINE SHAFT....................	EA	1
23	20	PAHZZ	5330-00-237-6266	15434	156444	.RING,OIL SEAL PART OF KIT P/N 3003807.............	EA	1
23	21	PAHZZ	2990-01-085-4768	15434	3000164	.HOUSING,COMPRESSOR................................	EA	1
23	22	PAHZZ	5330-00-026-2933	15434	202457	.PACKING,PREFORMED PART OF KIT P/N 3003807.........	EA	1
23	23	XDHZZ		15434	3000560	.ELBOW OIL DRAIN...................................	EA	1
23	24	PAHZZ	5330-00-632-6182	15434	170510	.PAD TEFLON..	EA	1
23	25	PAHZZ	5340-00-400-3449	15434	108722	.CLAMP,LOOP..	EA	2
23	26	PAHZZ	3120-00-682-7706	15434	156420	.BEARING TURBOCHARGER..............................	EA	1
23	27	PAHZZ	2950-00-432-1559	15434	202376	.HOUSING,BEARING...................................	EA	1
23	28	PCHZZ	4720-01-085-1316	15434	AC1600300NF	.HOSE,DRAIN..	EA	1

(1) ILLUS-TRATION (a) FIG. NO.	(1) ILLUS-TRATION (b) ITEM NO.	(2) SMR CODE	(3) NATIONAL STOCK NUMBER	(4) FSCM	(5) PART NUMBER	(6) DESCRIPTION	(6) USABLE ON CODE	(7) U/M	(8) QTY INC IN UNIT
						0305(CONT)			
23	29	PAHZZ	4710-01-079-3487	15434	3016456	.TUBE OIL DRAIN....................................		EA	1
23	30	PAFZZ	4730-01-079-3274	15434	3003536	.ELBOW OIL DRAIN,BEARING HOUSING....................		EA	1
23	31	PAHZZ	5330-00-406-7789	15434	202377	.PACKING,INSULATION.................................		EA	1
23	32	PAHZZ	2990-00-477-6159	15434	171570	.SHIELD,HEAT..		EA	1
23	33	PCHZZ	5365-00-135-2166	15434	195840	.SEAL,RING..		EA	2
23	34	PAHZZ	2950-01-086-1447	15434	214086	.ROTOR SHAFT TURBINE ASSEMBLY.......................		EA	1
23		PAHZZ	2950-01-071-5367	15434	3003807	KIT TURBOCHARGER REPAIR.............................		EA	1
23	2					SCREW,DRIVE...		EA	4
23	3					PLATE,NAME,TURBO....................................		EA	1
23	16					SEAL,OIL,SLEEVE.....................................		EA	1
23	17					RING,OIL SEAL.......................................		EA	1
23	20					RING,OIL SEAL.......................................		EA	1
23	22					PACKING,PREFORMED...................................		EA	1

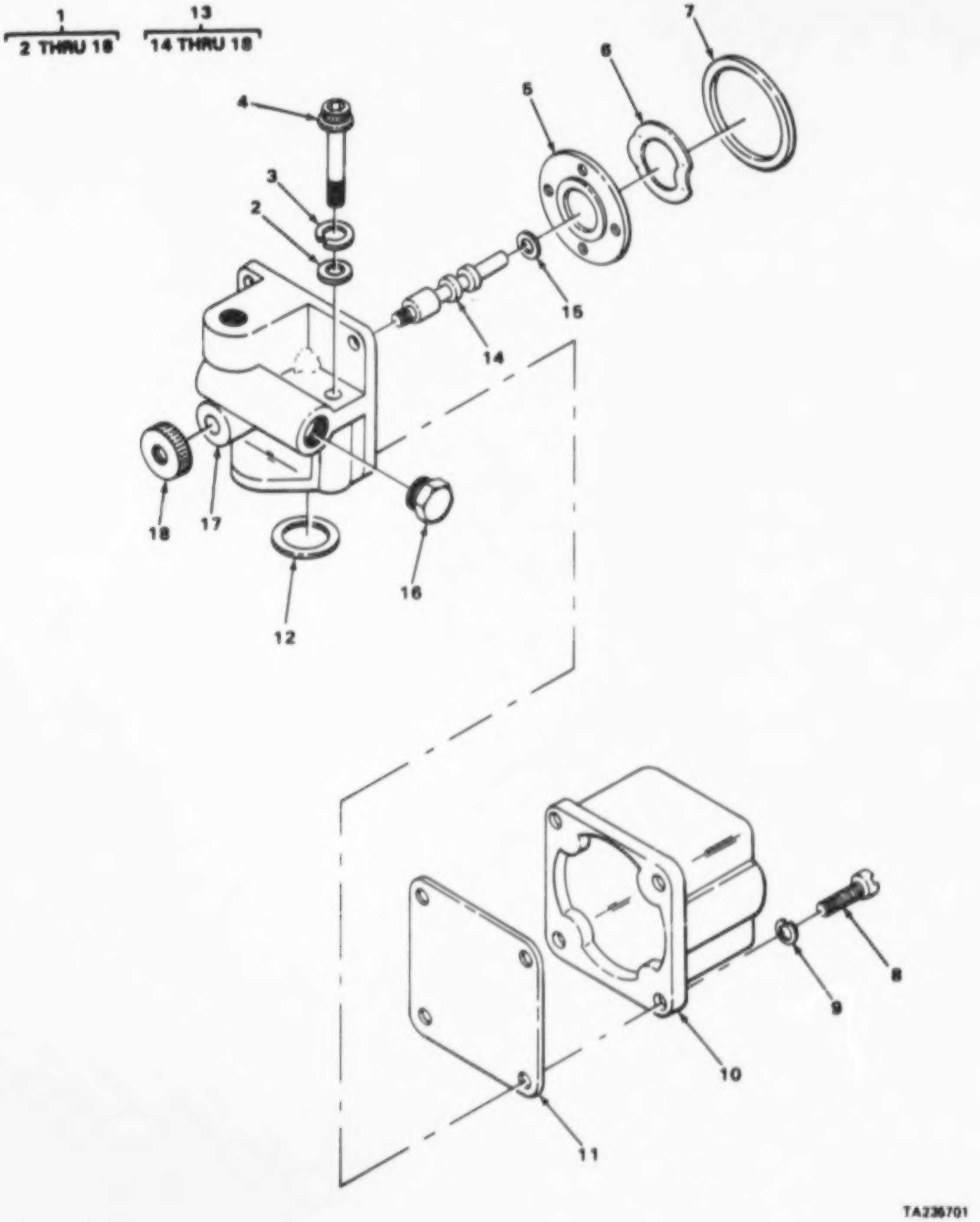
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FIGURE 24. FUEL SOLENOID SHUTOFF VALVE ASSEMBLY.

(1) ILLUS-TRATION (a) FIG. NO.	(1) ILLUS-TRATION (b) ITEM NO.	(2) SMR CODE	(3) NATIONAL STOCK NUMBER	(4) FSCM	(5) PART NUMBER	(6) DESCRIPTION USABLE ON CODE	(7) U/M	(8) QTY INC IN UNIT
						0306-TANKS, LINES, FITTINGS, HEADERS		
24	1	PAOFF	4810-00-695-3284	15434	8M69973	VALVE,SOLENOID....................................	EA	1
24	2	PAOZZ	5310-00-262-2986	15434	67684	.WASHER,FLAT FUEL SOLENOID SHUTOFF ASSEMBLY MOUNTING..	EA	2
24	3	PAOZZ	5310-00-484-1718	15434	181466	.WASHER,LOCK FUEL SOLENOID SHUTOFF ASSEMBLY MOUNTING..	EA	2
24	4	PAOZZ	5305-00-509-8106	15434	S189C	.SCREW,CAP,SOCKET HE FUEL SOLENOID SHUTOFF VALVE ASSEMBLY MOUNTING..............................	EA	2
24	5	PAOZZ	2910-01-146-1048	15434	3030970	.DISK,VALVE FUEL,SHIELD TO VALVE HOUSING ASSEMBLY..	EA	1
24	6	PAOZZ	5310-00-082-1888	15434	129768	.WASHER,SPRING TENSI................................	EA	1
24	7	PCOZZ	5330-00-081-9299	15434	129888	.PACKING,PREFORMED PART OF KIT P/N 3010242.........	EA	1
24	8	PAOZZ	5305-00-138-9848	15434	187556	.SCREW,MACHINE COIL ASSEMBLY MOUNTED...............	EA	4
24	9	XDOZZ		24617	120217	.LOCKWASHER...	EA	4
24	10	PAOZZ	2910-01-121-8859	15434	134072	.COIL ASSEMBLY......................................	EA	1
24	11	PAOZZ	2910-00-084-7787	15434	129839	.COVER,ACCESS.......................................	EA	1
24	12	PCOZZ	5330-00-951-3538	91265	TS33-016	.GASKET PART OF KIT P/N 3010242....................	EA	1
24	13	PAFFF	2910-00-455-1406	15434	8M65725	.VALVE HOUSING ASSEM FUEL PUMP MOUNTED............	EA	1
24	14	PAFZZ	4820-00-084-7813	15434	196037	..SHAFT,OVERRIDE..................................	EA	1
24	15	PCFZZ	5330-00-132-0274	15434	190876	..PACKING,PREFORMED PART OF KIT P/N 3010242........	EA	1
24	16	PAFZZ	4730-00-011-3175	15434	70295	..PLUG,PIPE VALVE HOUSING MOUNTED.................	EA	1
24	17	PAFZZ	2990-00-829-5600	15434	129826	..HOUSING SHUTOFF VALVE...........................	EA	1
24	18	PAFZZ	5355-00-082-1189	15434	129838	..KNOB,OVERRIDE VALVE HOUSING MOUNTED.............	EA	1

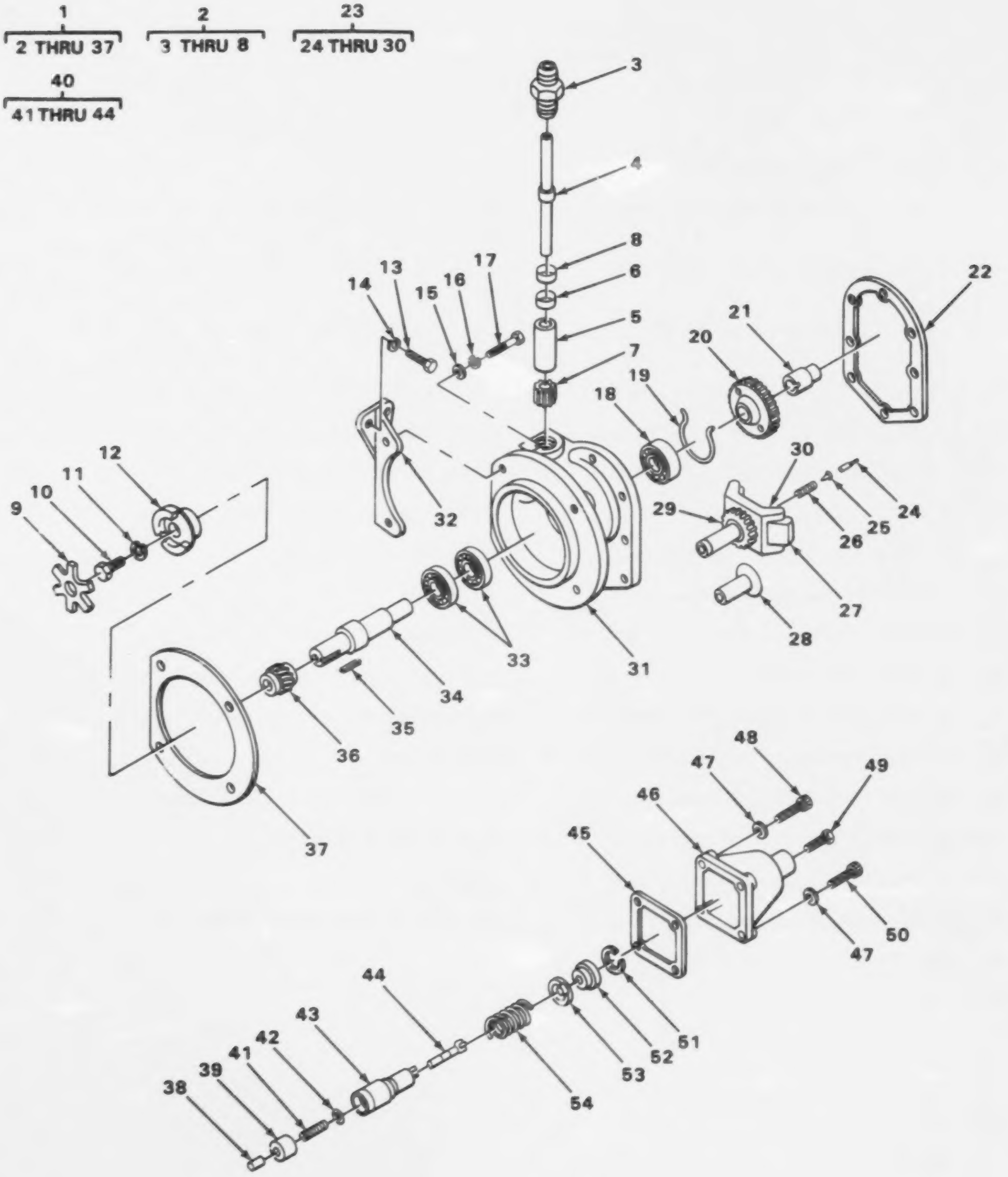
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FIGURE 25. COVER, GOVERNOR AND TACHOMETER DRIVE, IDLE CONTROL ASSEMBLY.

(1) ILLUSTRATION (a) FIG. NO.	(1) ILLUSTRATION (b) ITEM NO.	(2) SMR CODE	(3) NATIONAL STOCK NUMBER	(4) FSCM	(5) PART NUMBER	(6) DESCRIPTION	(6) USABLE ON CODE	(7) U/M	(8) QTY INC IN UNIT
						0308-ENGINE SPEED GOVERNOR AND CONTROLS			
25	1	PAFHH	2910-01-085-5339	15434	AR-41019	COVER GOVERNOR AND TACHOMETER DRIVE		EA	1
25	2	PBHHH	2910-01-092-9818	15434	AR41007	.DRIVE,TACHOMETER		EA	1
25	3	PAHZZ	2910-01-086-7715	15434	3002110	..COUPLING SCREW		EA	1
25	4	PAHZZ	6680-01-085-2871	15434	212607	..SHAFT,TACH DRIVE		EA	1
25	5	PAHZZ	3120-01-087-2539	15434	212609	..BUSHING,TACH		EA	1
25	6	XDHZZ		15434	3004724	..SPACER,SLEEVE		EA	1
25	7	PAHZZ	3020-01-086-8780	15434	212610	..GEAR,TACH		EA	1
25	8	PCHZZ	5330-01-072-8828	15434	212603	..SEAL PART OF KIT P/N 3010242		EA	1
25	9	PAHZZ	2910-00-112-7950	15434	162426	.SPIDER,COUPLING		EA	1
25	10	PAHZZ	5310-01-114-9279	15434	S110	.SCREW CAP,HEXAGON H		EA	1
25	11	PAHZZ	5310-00-407-9566	96906	MS35338-45	.WASHER,LOCK COUPLING TO DRIVE SHAFT		EA	1
25	12	PAHZZ	3040-01-080-1529	15434	212613	.COUPLING,DRIVE		EA	1
25	13	XDFZZ		15434	S151	.SCREW,CAP,HEXAGON H BRACKET TO ENGINE BLOCK		EA	1
25	14	PAFZZ	5310-00-209-0965	96906	MS35338-47	.WASHER,LOCK BRACKET TO ENGINE BLOCK		EA	1
25	15	XDFZZ		15434	69324	.WASHER,FLAT		EA	1
25	16	PAFZZ	5310-00-209-0965	96906	MS35338-47	.WASHER,LOCK		EA	1
25	17	XDFZZ		15434	206326	.SCREW,CAP TWELVE PT		EA	1
25	18	PAHZZ	3110-00-516-5289	15434	S16052	.BEARING,BALL		EA	1
25	19	PAHZZ	5365-01-081-0662	15434	212604	.RING,RETAINING		EA	1
25	20	PAHZZ	2910-01-070-9003	15434	212605	.GEAR GOVERNOR DRIVE		EA	1
25	21	PAHZZ	3010-01-088-5727	15434	212639	.COUPLING		EA	1
25	22	PCHZZ	5330-00-506-4866	15434	100764	.GASKET PART OF KIT P/N 3010242		EA	1
25	23	PAHHH	2990-01-088-5922	15434	3017996	.WEIGHT AND CARRIER ASSEMBLY		EA	1
25	24	PAHZZ	5315-00-082-0448	15434	144178	..PLUNGER WEIGHT ASSIST		EA	1
25	25	PAHZZ	5310-00-727-8353	15434	144179	..SHIM WEIGHT ASSIST		EA	1
25	26	PAHZZ	5360-01-095-3661	15434	143848	..SPRING,HELICAL		EA	1
25	27	XAHZZ		15434	AR41017	..WEIGHT AND CARRIER		EA	1
25	28	PAHZZ	3120-00-904-9595	15434	163944	..BUSHING,GOVERNOR WEIGHT SHAFT		EA	1

(1) ILLUSTRATION (a) FIG. NO.	(1) ILLUSTRATION (b) ITEM NO.	(2) SMR CODE	(3) NATIONAL STOCK NUMBER	(4) FSCM	(5) PART NUMBER	(6) DESCRIPTION USABLE ON CODE	(7) U/M	(8) QTY INC IN UNIT
						0308(CONT)		
25	29	PAHZZ	3020-01-070-8528	15434	211636	..GEAR,GOVERNOR WEIGHT SHAFT	EA	1
25	30	PBHZZ	2910-00-451-8063	15434	146437	..WEIGHT,LINKAGE GOV	EA	1
25	31	PBHZZ	6680-01-085-2870	15434	AR41009	.COVER FRONT AND TACH DRIVE	EA	1
25	32	PAHZZ	2530-01-085-4153	15434	3001296	.BRACKET,SUPPORT AIR COMPRESSOR	EA	1
25	33	PCHZZ	5330-01-072-8829	15434	3019962	.PACKING,PREFORMED PART OF KIT P/N 3010242	EA	2
25	34	PAHZZ	2910-01-070-9004	15434	212601	.SHAFT,SHOULDERED	EA	1
25	35	XDHZZ		15434	212668	.KEY,MACHINE	EA	1
25	36	XDHZZ		15434	212602	.GEAR TACHOMETER DRIVE	EA	1
25	37	PAHZZ	5330-00-471-0370	15434	3035053	.GASKET PART OF KIT P/N 3010242, 3018762	EA	1
25	38	PAHZZ	5330-01-072-8830	15434	3003156	SEAL,LEAD	EA	1
25	39	PAHZZ	2815-00-907-8964	15434	137370	PLUNGER IDLE SPRING	EA	1
25	40	PAHHH	2910-00-803-2631	15434	BM69889	PACK IDLE SPRING	EA	1
25	41	PAHZZ	5360-00-082-0124	15434	144195	.SPRING,HELICAL COMPRESSION IDLE	EA	1
25	42	PAHZZ	5310-00-507-3259	15434	70715	.WASHER ADJUSTING SCREW	EA	1
25	43	PAHZZ	2910-00-132-0769	15434	BM67416	.GUIDE CLIP ASSEMBLY	EA	1
25	44	PAHZZ	5305-00-506-5722	15434	70716	.SCREW IDLE ADJUSTING	EA	1
25	45	PCHZZ	5330-00-562-1176	15434	70705	GASKET PART OF KIT P/N 3010242	EA	1
25	46	PAHZZ	2910-00-858-3522	15434	44678	COVER SPRING PACK	EA	1
25	47	PAHZZ	5310-00-141-1795	88044	AN906-416	WASHER,FLAT	EA	4
25	48	PAHZZ	5305-01-072-8831	15434	203619	SCREW,CAP,HEXAGON H	EA	1
25	49	PAHZZ	4730-00-369-7824	15434	177999	PLUG,PIPE	EA	1
25	50	PAHZZ	5305-00-426-4142	15434	S105	SCREW,CAP 12 POINT	EA	3
25	51	PAHZZ	5365-01-079-7142	15434	3001704	RING,RETAINING	EA	1
25	52	PAHZZ	5340-00-898-1497	15434	70713	RETAINER,SPRING	EA	1
25	53	PAHZZ	5365-00-462-4504	15434	70717B	SHIM 0.005 INCH THICK	EA	V
25	53	PAHZZ	5365-00-507-3261	15434	70717A	SHIM 0.010 INCH THICK	EA	V
25	53	PAHZZ	5365-00-507-3260	15434	70717	SHIM 0.020 INCH THICK	EA	V
25	54	PAHZZ	5360-00-461-5738	15434	143251	SPRING,HELICAL COMPRESSION HI-SPEED	EA	1

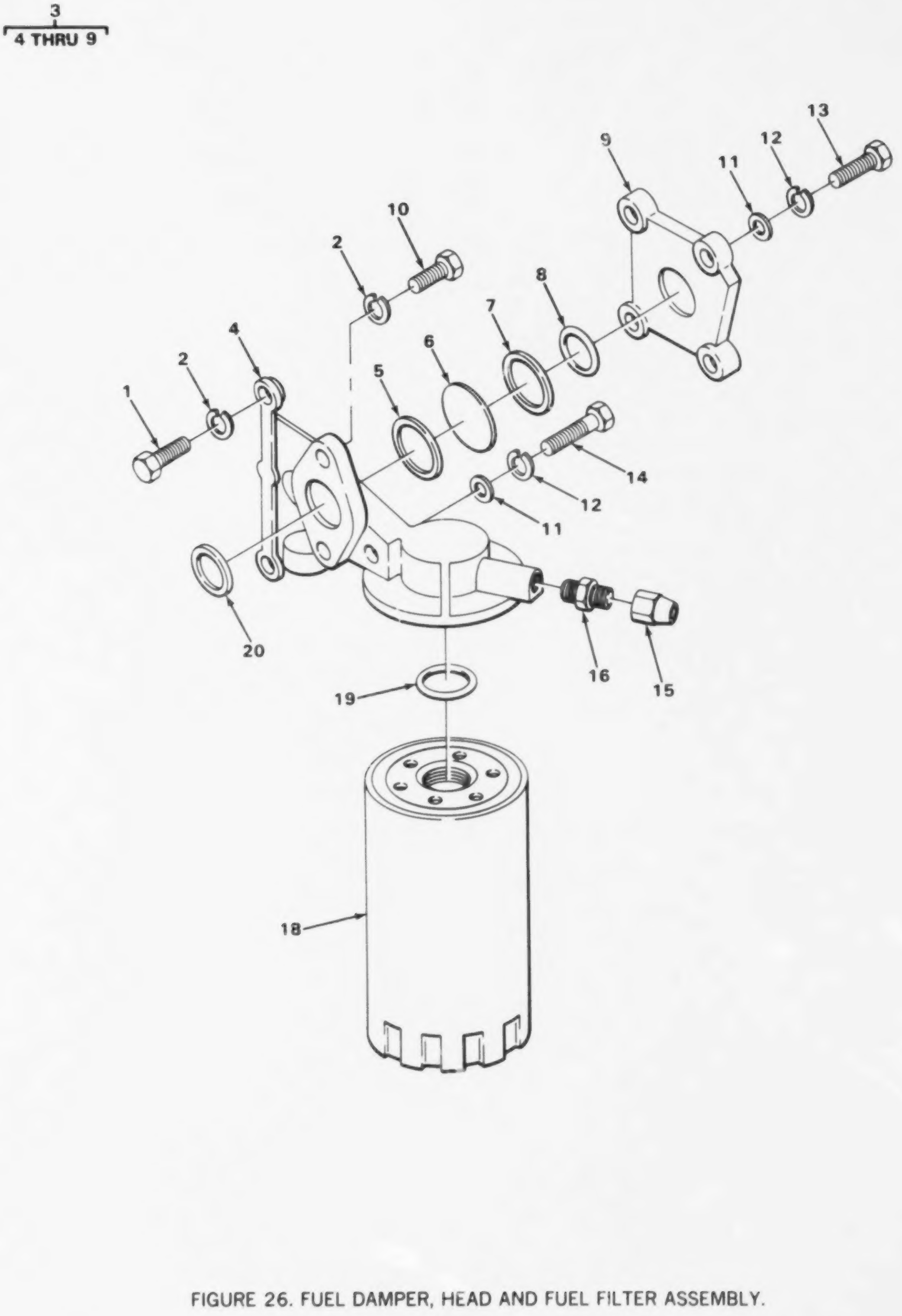
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FIGURE 26. FUEL DAMPER, HEAD AND FUEL FILTER ASSEMBLY.

(1) ILLUSTRATION (a) FIG. NO.	(1) ILLUSTRATION (b) ITEM NO.	(2) SMR CODE	(3) NATIONAL STOCK NUMBER	(4) FSCM	(5) PART NUMBER	(6) DESCRIPTION	USABLE ON CODE	(7) U/M	(8) QTY INC IN UNIT
						0309-FUEL FILTERS			
26	1	PAFZZ	5305-00-426-4142	15434	S105	SCREW,CAP,HEXAGON H DAMPER TO GEAR MOTOR...........		EA	2
26	2	PAFZZ	5310-00-484-1718	15434	181466	WASHER,LOCK DAMPER TO GEAR MOTOR..................		EA	4
26	3	PAFFF	2910-01-085-2570	15434	AR12220	DAMPER FUEL FILTER................................		EA	1
26	4	XAFZZ		15434	215787	.HEAD DAMPER ASSEMBLY.............................		EA	1
26	5	PAFZZ	5330-00-809-3276	15434	139988	.PACKING,PREFORMED................................		EA	1
26	6	PAFZZ	2910-00-951-3536	15434	202897	.DISC,SOLID,PLAIN.................................		EA	1
26	7	PCFZZ	5330-00-809-2667	15434	100099	.PACKING,PREFORMED................................		EA	1
26	8	PAFZZ	5365-00-965-0870	15434	160514	.SPACER,RING......................................		EA	1
26	9	PAFZZ	2910-00-829-5617	15434	153338	.PLATE,DAMPER.....................................		EA	1
26	10	PAFZZ	5305-00-207-2715	15434	S174C	SCREW,CAP,SOCKET HE DAMPER TO GEAR MOTOR...........		EA	2
26	11	PAFZZ	5310-00-141-1795	88044	AN960-416	WASHER,FLAT DAMPER TO GEAR MOTOR..................		EA	4
26	12	PAFZZ	5310-00-562-6552	15434	S600	WASHER,LOCK DAMPER TO GEAR MOTOR..................		EA	2
26	13	XDFZZ		15434	133538	SCREW,CAP,SOCKET HE DAMPER TO GEAR MOTOR...........		EA	1
26	14	XDFZZ		15434	153346	SCREW,CAP,SOCKET HE DAMPER TO GEAR MOTOR...........		EA	1
26	15	XDFZZ		15434	AR12228	FITTING FUEL INLET................................		EA	1
26	16	PAFZZ	4730-01-106-4700	15434	129866	UNION,MALE..		EA	1
26	18	PAOZZ	2910-00-174-5822	33457	FS1212	FUEL FILTER ELEMENT...............................		EA	1
26	19	PCOZZ	5330-01-084-9068	33457	255622	PACKING,PREFORMED PART OF KIT P/N 3010242..........		EA	1
26	20	PAFZZ	5330-00-080-0483	15434	151900	GASKET PART OF KIT P/N 3010242.....................		EA	1
26		PAFZZ	5330-01-075-0948	15434	3010242	KIT,GASKET..		EA	1
20	10					GASKET..		EA	1
20	18					PACKING,PREFORMED.................................		EA	1
20	19					PACKING,PREFORMED.................................		EA	1
20	20					PACKING,PREFORMED.................................		EA	1
20	64					PACKING,PREFORMED.................................		EA	1
20	69					O-RING..		EA	1
20	71					PACKING,PREFORMED.................................		EA	1
22	12					GASKET..		EA	1
22	17					GASKET..		EA	1
24	7					PACKING,PREFORMED.................................		EA	1
24	12					GASKET..		EA	1
24	15					PACKING,PREFORMED.................................		EA	1
25	8					SEAL..		EA	1
25	22					GASKET..		EA	1
25	33					PACKING,PREFORMED.................................		EA	2
25	37					GASKET..		EA	1

(1) ILLUSTRATION (a) FIG. NO.	(1) ILLUSTRATION (b) ITEM NO.	(2) SMR CODE	(3) NATIONAL STOCK NUMBER	(4) FSCM	(5) PART NUMBER	(6) DESCRIPTION USABLE ON CODE	(7) U/M	(8) QTY INC IN UNIT
						0309(CONT)		
25	45					GASKET..	EA	1
26	19					PACKING,PREFORMED.................................	EA	1
26	20					GASKET..	EA	1

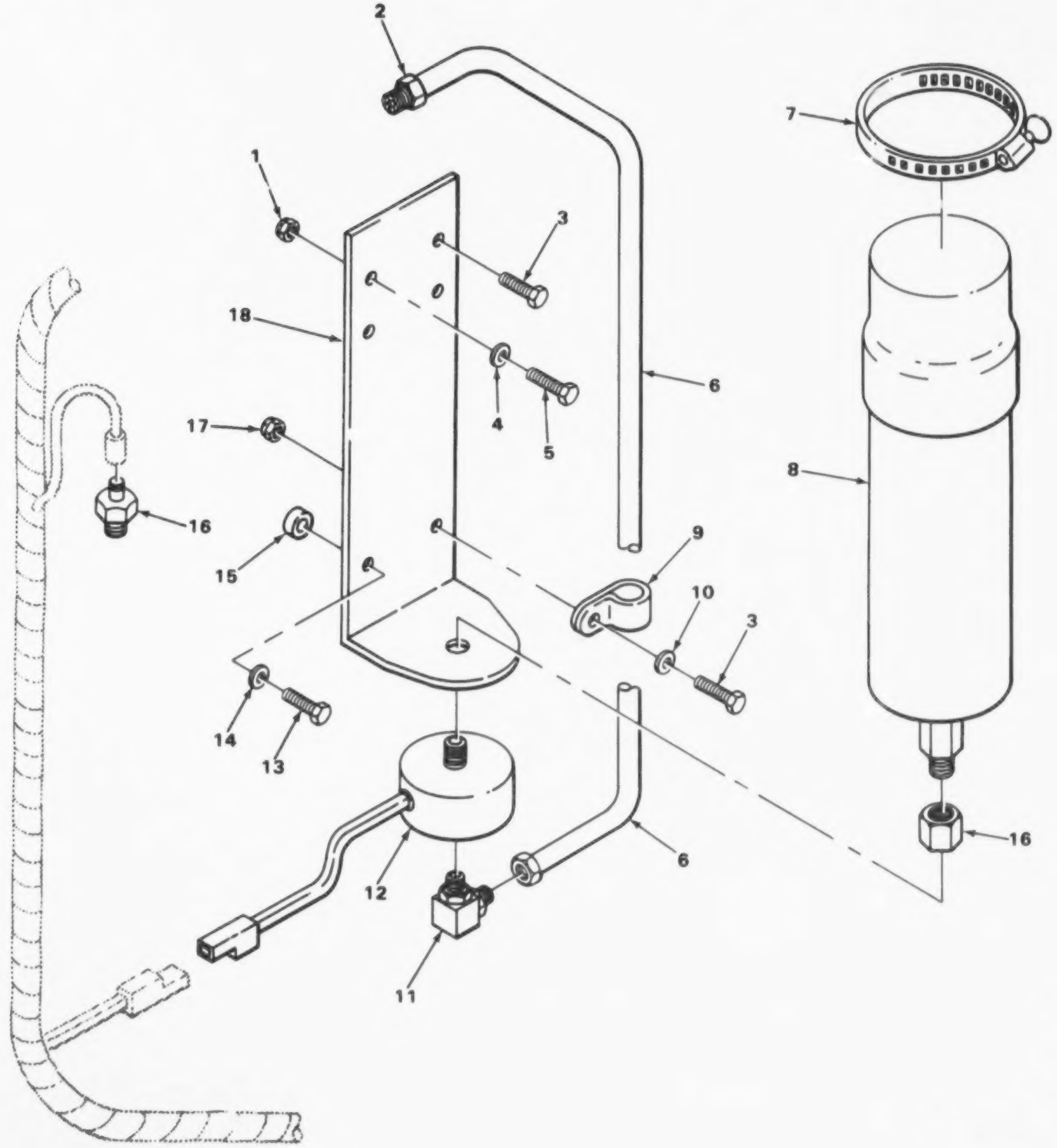
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FIGURE 27. ETHER QUICK START KIT.

(1) ILLUS-TRATION (a) FIG. NO.	(b) ITEM NO.	(2) SMR CODE	(3) NATIONAL STOCK NUMBER	(4) FSCM	(5) PART NUMBER	(6) DESCRIPTION USABLE ON CODE	(7) U/M	(8) QTY INC IN UNIT
						0311-ENGINE STARTING AIDS		
27	1	PAOZZ	5310-01-146-6147	06991	102030	NUT,PLAIN,HEXAGON PART OF KIT P/N 8294151..........	EA	2
27	2	PAOZZ	2910-01-112-5797	06991	913024-06	ATOMIZER,QUICK STAR PART OF KIT P/N 8294151........	EA	1
27	3	PAOZZ	5305-01-097-9886	24617	9419002	SCREW,CAP,HEXAGON H PART OF KIT P/N 8294151........	EA	2
27	4	PAOZZ		06991	103031	WASHER, PART OF KIT P/N 8294151....................	EA	2
27	5	PAOZZ	5306-01-151-1023	06991	101037-05	BOLT,MACHINE PART OF KIT P/N 8294151...............	EA	2
27	6	PCOZZ	4720-01-146-4126	06991	501096-04	TUBING,NONMETALLIC PART OF KIT P/N 8294151.........	EA	1
27	7	PBOZZ	5340-01-145-1181	06991	913020	CLAMP,LOOP PART OF KIT P/N 8294151.................	EA	1
27	8	PAOZZ	2910-00-646-9727	96906	MS39254	CARTRIDGE,ENGINE ST PART OF KIT P/N 8294151........	EA	1
27	9	PAOZZ	5340-00-809-1490	96906	MS21333-98	CLAMP,LOOP PART OF KIT P/N 8294151.................	EA	1
27	10	PAOZZ	5310-01-102-3270	24617	2436161	WASHER,FLAT PART OF KIT P/N 8294151................	EA	1
27	11	PAOZZ	4730-01-146-1059	06991	125049	ELBOW,PIPE TO TUBE PART OF KIT P/N 8294151.........	EA	1
27	12	PAOZZ	2910-01-084-0243	06991	913032-04	ETHER STARTING AID PART OF KIT P/N 8294151.........	EA	1
27	13	PAOZZ	5306-00-418-2276	24617	272547	BOLT,MACHINE.......................................	EA	2
27	14	PAOZZ	5310-01-146-7303	34623	M-B362-20001	WASHER,FLAT VALVE ASSY TO AFTERCOOLER..............	EA	2
27	15	PAOZZ		06991	501088-02	SPACER,BRKT MTG....................................	EA	2
27	16	PAOZZ	5930-01-127-2113	06991	321028-01	SWITCH,THERMOSTATIC PART OF KIT P/N 8294151........	EA	1
27	17	PAOZZ	5310-01-099-0389	24617	9422273	NUT PART OF KIT P/N 8294151........................	EA	1
27	18	PAOZZ	5340-01-146-9816	06991	108289	CLAMP PART OF KIT P/N 8294151......................	EA	1
27		PBOZZ	2815-01-087-4740	06991	8294151	QUICK START KIT....................................	EA	1
27	1					NUT,PLAIN,HEXAGON..................................	EA	2
27	2					ATOMIZER,QUICK STAR................................	EA	1
27	3					SCREW,CAP,HEXAGON H................................	EA	2
27	4					WASHER,FLAT..	EA	2
27	5					BOLT,MACHINE.......................................	EA	2
27	6					TUBING,NONMETALLIC.................................	EA	1
27	7					CLAMP,LOOP...	EA	1
27	8					CARTRIDGE,ENGINE ST................................	EA	1
27	9					CLAMP,LOOP...	EA	1
27	10					WASHER,FLAT..	EA	1
27	11					ELBOW,PIPE TO TUBE.................................	EA	1
27	12					ETHER STARTING AID.................................	EA	1
27	16					SWITCH,THERMOSTATIC................................	EA	1
27	17					NUT..	EA	1
27	18					CLAMP..	EA	1

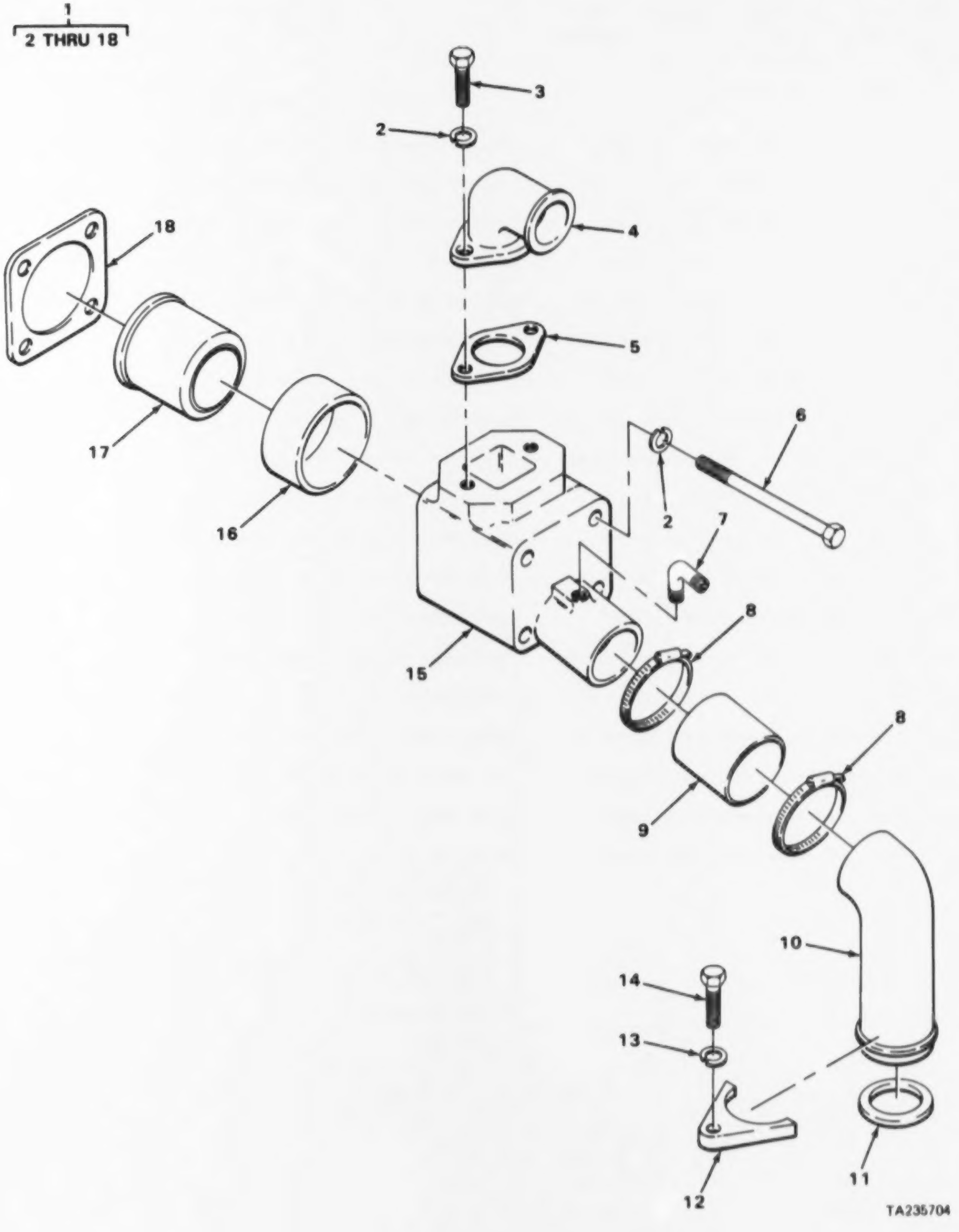
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FIGURE 28. THERMOSTAT HOUSING ASSEMBLY.

(1) ILLUSTRATION		(2) SMR CODE	(3) NATIONAL STOCK NUMBER	(4) FSCM	(5) PART NUMBER	(6) DESCRIPTION USABLE ON CODE	(7) U/M	(8) QTY INC IN UNIT
(a) FIG. NO.	(b) ITEM NO.							
						GROUP 05-COOLING SYSTEM 0503-WATER MANIFOLD, HEADERS, THERMOSTATS AND HOUSING GASKET		
28	1	PB000	6620-01-085-3579	15434	AR10124	HOUSING ASSEMBLY THERMOSTAT,FRONT WATER BYPASS ASSEMBLY TO WATER MANIFOLD ASSEMBLY.................	EA	1
28	2	PAOZZ	5310-00-261-7340	96906	MS35338-8	.WASHER,LOCK.......................................	EA	6
28	3	PAOZZ	5305-01-085-8197	15434	3010595	.SCREW,MACHINE WATER OUTLET CONNECTION MOUNTING....	EA	2
28	4	PAOZZ	4730-01-079-7459	15434	210916	.ELBOW,FLANGE TO HOS................................	EA	1
28	5	PAOZZ	5330-01-080-1773	15434	3019158	.GASKET PART OF KIT P/N 3801350....................	EA	1
28	6	PAOZZ	5305-01-086-7036	15434	3010597	.SCREW THERMOSTAT HOUSING ASSEMBLY MOUNTING........	EA	4
28	7	PAOZZ	4730-01-085-4156	15434	196282	.CONNECTION,AIR INLE................................	EA	1
28	8	PAOZZ	4730-00-909-8627	96906	MS35842-13	.CLAMP,HOSE WATER BYPASS HOSE,THERMOSTAT HOUSING ASSEMBLY TO WATER BYPASS TUBE......................	EA	2
28	9	PAOZZ	4720-01-085-6129	15434	102522	.HOSE,NONMETALLIC BYPASS THERMOSTAT HOUSING ASSEMBLY TO WATER BYPASS TUBE......................	EA	1
28	10	PAOZZ	4710-01-079-3198	15434	213485	.TUBE,BENT,METALLIC.................................	EA	1
28	11	PAOZZ	5330-00-159-1464	15434	43463-A	.PACKING,PREFORMED PART OF KIT P/N 3801350.........	EA	1
28	12	PBOZZ	5340-01-135-7250	15434	214617	.CLAMP,RIM CLENCHING WATER BYPASS TUBE TO WATER PUMP...	EA	1
28	13	PAOZZ	5310-00-407-9566	96906	MS35338-45	.WASHER,LOCK FRONT WATER BYPASS ASSEMBLY...........	EA	1
28	14	PAOZZ	5305-01-114-9279	15434	5110	.SCREW,CAP,HEXAGON H................................	EA	1
28	15	PBOZZ	6620-01-084-6011	15434	211435	.HOUSING,THERMOSTAT HOUSING ASSEMBLY TO WATER HOSE.	EA	1
28	16	PAOZZ	5330-00-864-5422	15434	186780	.SEAL,THERMO PART OF KIT P/N 3801350...............	EA	1
28	17	PAOZZ	6620-01-047-2811	15434	204586	.THERMOSTAT,FLOW CON................................	EA	1
28	18	PAOZZ	5330-01-040-2087	15434	208128	.GASKET PART OF KIT P/N 3801350....................	EA	1

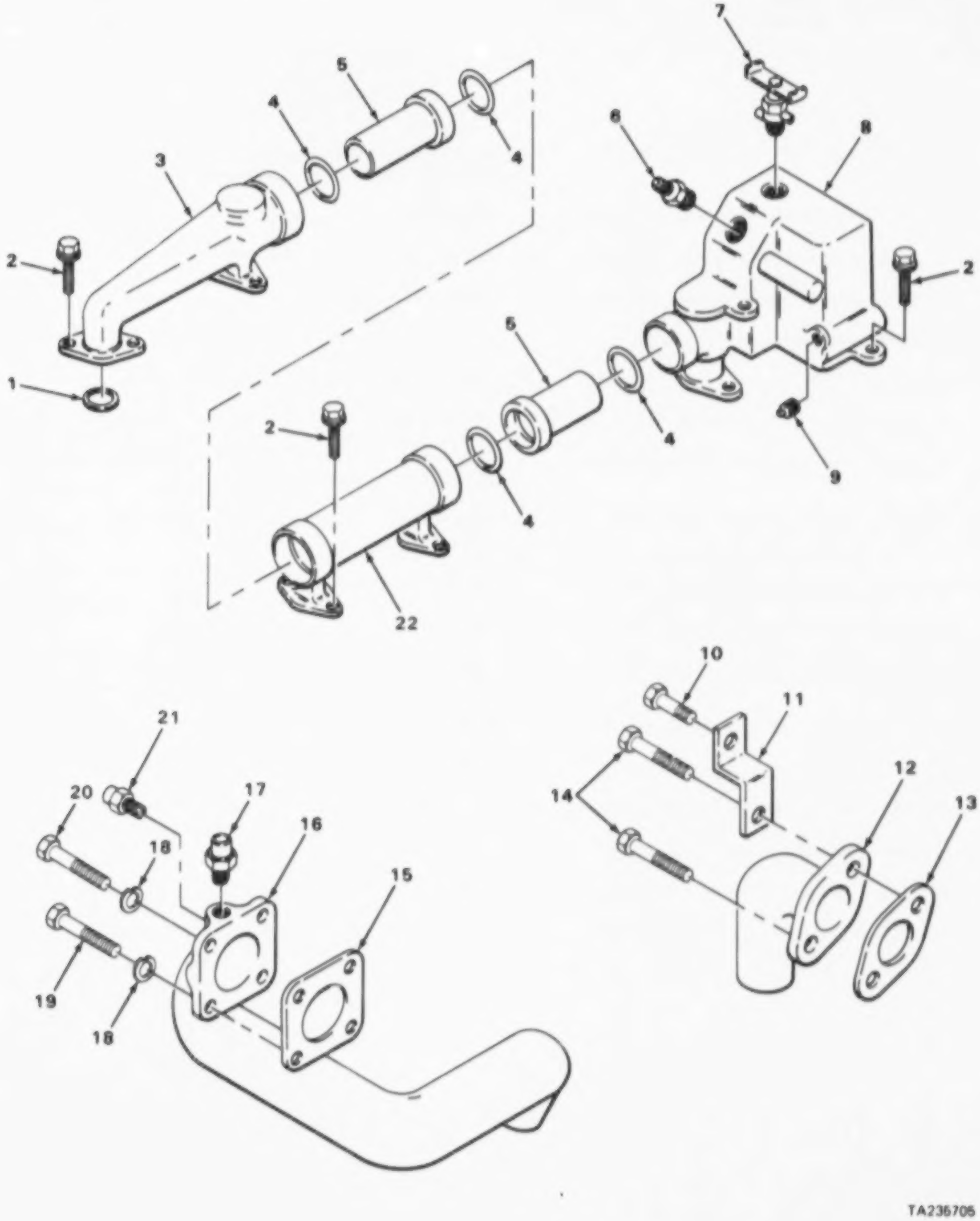
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FIGURE 29. WATER MANIFOLDS, FRONT, CENTER, REAR.

(1) ILLUSTRATION (a) FIG. NO.	(1) ILLUSTRATION (b) ITEM NO.	(2) SMR CODE	(3) NATIONAL STOCK NUMBER	(4) FSCM	(5) PART NUMBER	(6) DESCRIPTION USABLE ON CODE	(7) U/M	(8) QTY INC IN UNIT
						0503(CONT)		
29	1	PAOZZ	5330-00-143-8369	15434	3024709	GASKET PART OF KIT P/N 3801350	EA	6
29	2	PAOZZ	5305-01-088-6019	15434	3010596	SCREW,ASSEMBLED WAS	EA	16
29	3	PAOZZ	2930-01-087-8749	15434	3013000	MANIFOLD,FLUID COOL	EA	2
29	4	PAOZZ	5330-00-506-4874	15434	70624	PACKING,PREFORMED PART OF KIT P/N 3801350	EA	4
29	5	PAOZZ	4730-00-404-2906	15434	130394	COUPLING,MANIFOLD	EA	2
29	6	PAOZZ	4730-00-196-0936	24617	115224	BUSHING,PIPE BRASS 3/4 NPT TO 3/8 NPT	EA	1
29	7	PAOZZ	4820-01-210-9571	15434	214345	COCK,DRAIN FRONT WATER MANIFOLD MOUNTED	EA	1
29	8	PAOZZ	2815-01-083-2123	15434	215042	MANIFOLD,WATER FRONT	EA	1
29	9	PAOZZ	4730-00-221-2139	96906	MS20913-4S	PLUG,PIPE	EA	2
29	10	PAOZZ	5305-01-010-2362	96906	MS18154-59	SCREW,CAP,HEX H WATER TRANSFER CONNECTION MOUNTING	EA	1
29	11	PBOZZ	5340-01-080-6654	15434	3004261	BRACKET,DOUBLE ANGL	EA	1
29	12	PAOZZ	4730-01-085-9119	15424	3012438	ELBOW,FLANGE TO HOS	EA	1
29	13	PAOZZ	5330-01-086-6203	15434	3011931	GASKET PART OF KIT P/N 3801350	EA	1
29	14	PAOZZ	5305-01-085-8197	15434	3010595	SCREW,MACHINE	EA	2
29	15	PAOZZ	5330-01-146-7314	15434	3024960	GASKET PART OF KIT P/N 3801350	EA	1
29	16	PAOZZ	2815-01-079-3317	15434	216467	CONNECTION,WATER	EA	1
29	17	PAOZZ	4730-01-086-8652	79470	110-03270	ADAPTER,STRAIGHT,PI	EA	1
29	18	PAOZZ	5310-00-261-7340	96906	MS35338-8	WASHER,LOCK WATER TRANSFER CONNECTION MOUNTING	EA	4
29	19	PAOZZ	5305-00-206-4527	15434	S130A	SCREW,CAP,HEXAGON H	EA	2
29	20	PFOZZ	5305-01-143-8112	15434	3012476	SCREW,CAP,HEX HEAD	EA	2
29	21	PAOZZ	4730-00-289-1935	96906	MS51875-10	ADAPTER,STRAIGHT,PI	EA	1
29	22	PAOZZ	2930-00-928-3595	15434	130118	MANIFOLD,CENTER	EA	1

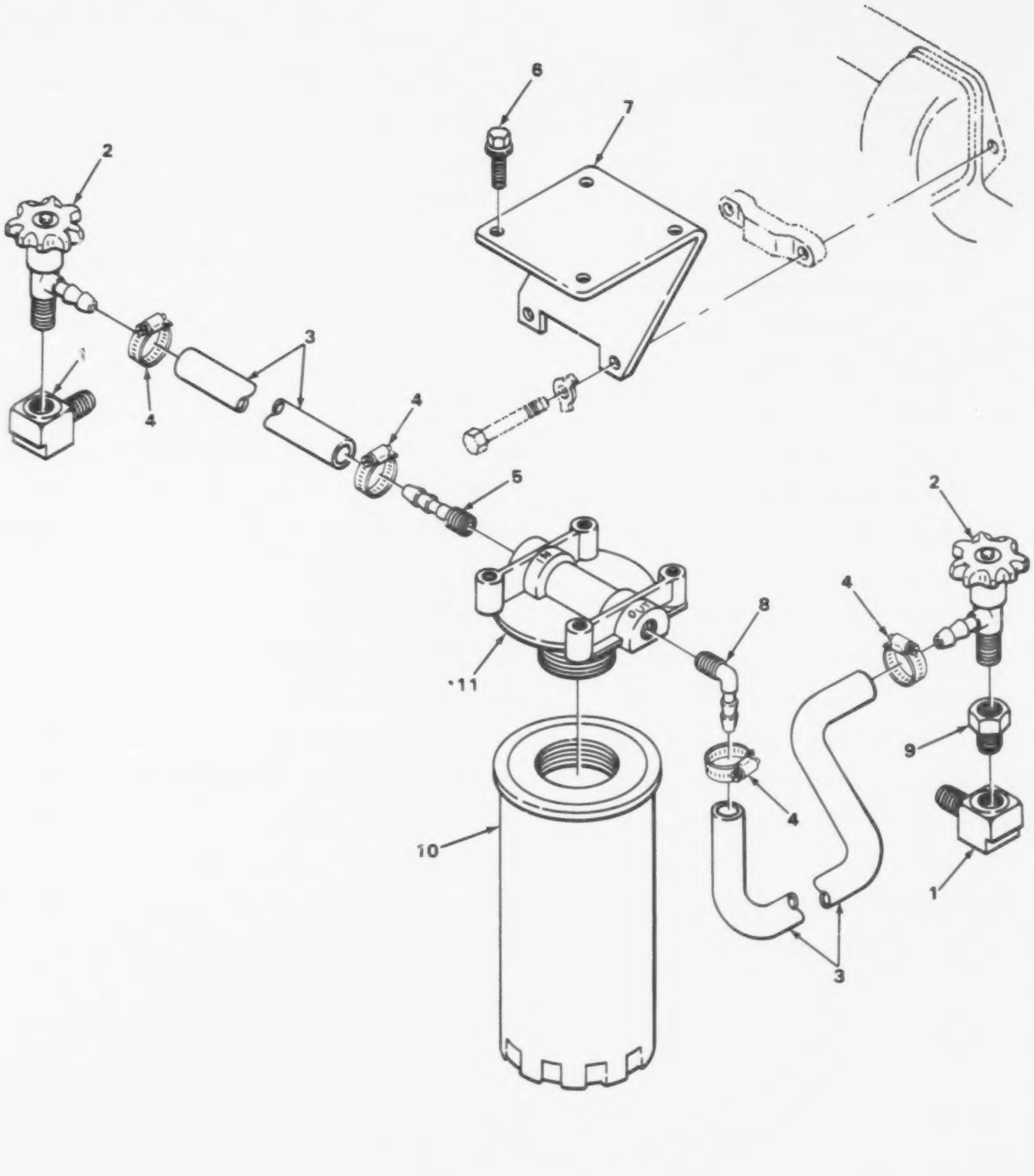
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FIGURE 30. COOLANT FILTER KIT.

(1) ILLUSTRATION		(2)	(3)	(4)	(5)	(6)	(7)	(8)
(a) FIG. NO.	(b) ITEM NO.	SMR CODE	NATIONAL STOCK NUMBER	FSCM	PART NUMBER	DESCRIPTION USABLE ON CODE	U/M	QTY INC IN UNIT
						0503(CONT)		
30	1	KFOZZ		34623	5730774	ELBOW PART OF KIT P/N 5739124......................	EA	2
30	2	KFOZZ		34623	5730765	VALVE PART OF KIT P/N 5739124......................	EA	2
30	3	KFOZZ		34623	5710454	HOSE PART OF KIT P/N 5739124.......................	EA	1
30	4	PAOZZ	4730-00-908-3195	96906	MS35842-10	CLAMP,HOSE PART OF KIT P/N 5739124.................	EA	4
30	5	KFOZZ		34623	5730775	FITTING PART OF KIT P/N 5739124....................	EA	1
30	6	KFOZZ		34623	MA25-21056	SCREW PART OF KIT P/N 5739124......................	EA	4
30	7	PAOZZ	5340-01-145-1597	34623	5730758	BRACKET,ANGLE PART OF KIT P/N 5739124..............	EA	1
30	8	PAOZZ	4730-01-165-0749	34623	5730751	ELBOW,TUBE PART OF KIT P/N 5739124.................	EA	1
30	9	KFOZZ		34623	5730770	ADAPTER PART OF KIT P/N 5739124....................	EA	1
30	10	KFOZZ		34623	5730768	FILTER PART OF KIT P/N 5739124.....................	EA	1
30	11	KFOZZ		34623	5730769	HEAD PART OF KIT P/N 5739124.......................	EA	1
30		PAOZZ	2930-01-184-1877	34623	5739124	KIT,COOLANT FILTER.................................	EA	1
30	1					ELBOW..	EA	2
30	2					VALVE..	EA	2
30	3					HOSE...	EA	1
30	4					CLAMP,HOSE...	EA	4
30	5					FITTING..	EA	1
30	6					SCREW..	EA	4
30	7					BRACKET,ANGLE......................................	EA	1
30	8					ELBOW,TUBE...	EA	1
30	9					ADAPTER..	EA	1
30	10					FILTER...	EA	1
30	11					HEAD...	EA	1

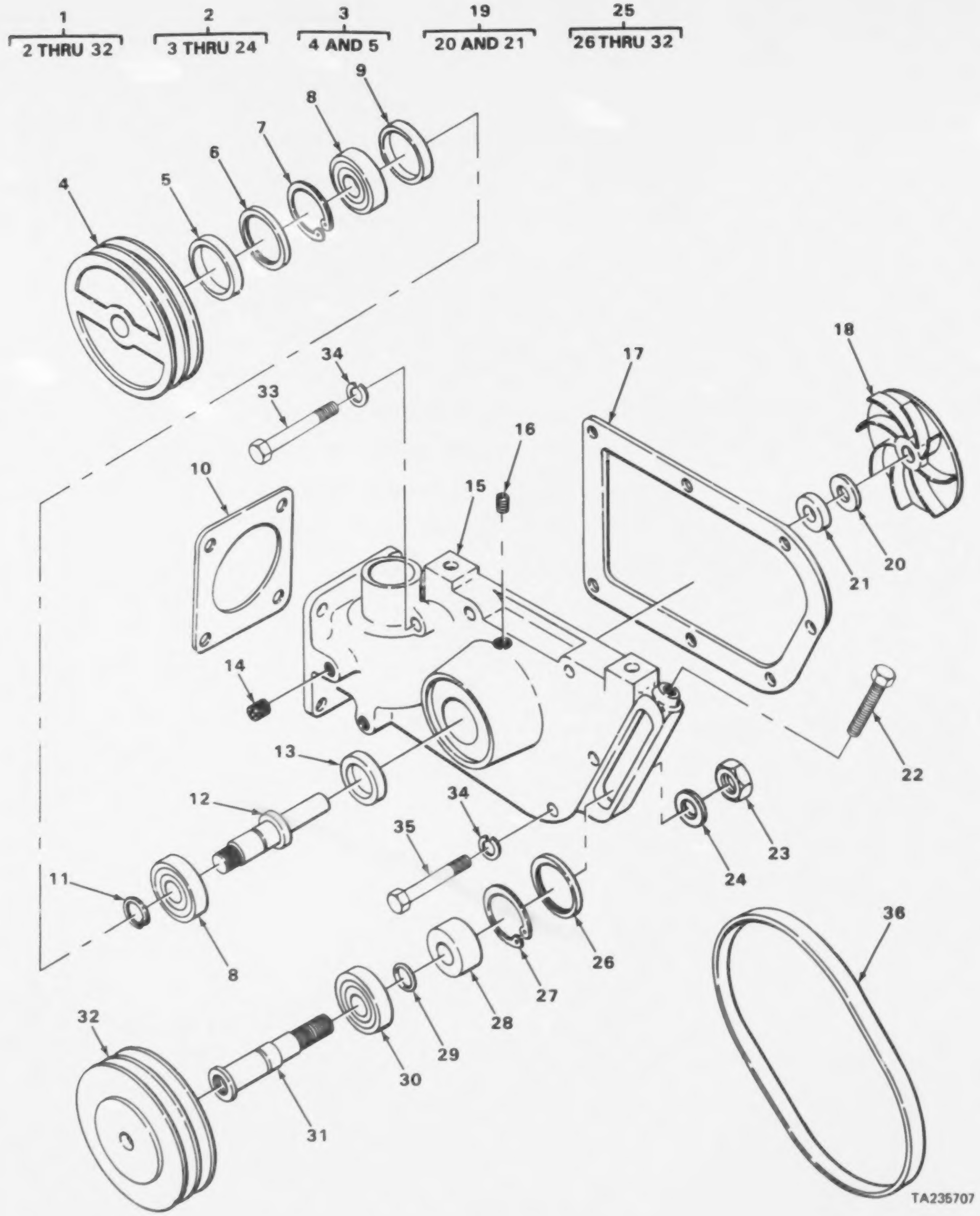
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FIGURE 31. WATER PUMP AND IDLER ASSEMBLY.

REPAIR PARTS LIST

(1) ILLUS- TRATION		(2)	(3)	(4)	(5)	(6)		(7)	(8)
(a) FIG. NO.	(b) ITEM NO.	SMR CODE	NATIONAL STOCK NUMBER	FSCM	PART NUMBER	DESCRIPTION	USABLE ON CODE	U/M	QTY INC IN UNIT
						0504-WATER PUMP			
31	1	PAOFF	2930-01-096-9035	15434	3801595	PUMP,WATER,ENGINE MOUNTED..........................		EA	1
31	2	PAOFF	2930-01-072-8056	15434	3022474	.PUMP,COOLANT ENGINE...............................		EA	1
31	3	PAFFF	3020-01-086-3417	15434	3007070	..PULLEY ASSEMBLY..................................		EA	1
31	4	XAFZZ		15434	3005507	...PULLEY..		EA	1
31	5	PAFZZ	3120-01-083-6411	15434	203097	...BEARING,SLEEVE..................................		EA	1
31	6	PAFZZ	5330-01-080-2992	15434	203101	..SEAL,OIL WATER PUMP PULLEY TO BALL BEARING.......		EA	1
31	7	PAFZZ	2815-00-815-0355	15434	S16255	..RING,BEARING RETAINER............................		EA	1
31	8	PAFZZ	3110-00-144-8519	15434	S16073	..BEARING,BALL WATER PUMP BEARINGS SPACER TO WATER PUMP SHAFT...		EA	2
31	9	PAFZZ	5365-01-132-1984	15434	196844	..SPACER BALL BEARING TO OIL SEAL..................		EA	1
31	10	PAOZZ	5330-01-146-7314	15434	3024960	..GASKET...		EA	1
31	11	PAFZZ	5365-01-097-5766	15434	117302	..RING,SNAP WATER PUMP SHAFT.......................		EA	1
31	12	PAFZZ	2930-01-079-2239	15434	3000889	..SHAFT,SHOULDERED.................................		EA	1
31	13	PAFZZ	5330-00-011-7939	94012	3038997	..GASKET PART OF KIT P/N 3018762...................		EA	1
31	14	PAFZZ	4730-00-010-3867	96906	MS51884-5	..PLUG,PIPE WATER PUMP HOUSING MOUNTED.............		EA	1
31	15	XDFZZ		15434	218274	..HOUSING..		EA	1
31	16	PAFZZ	4730-00-018-9566	15434	S9118	..PLUG,PIPE WATER PUMP HOUSING MOUNTED.............		EA	1
31	17	PAOZZ	5330-01-066-5350	15434	3002385	..GASKET PART OF KIT P/N 3018762...................		EA	1
31	18	PAFZZ	4320-01-079-3454	15434	3000888	..IMPELLER...		EA	1
31	19	PAFFF	5330-00-005-0407	15434	AR12732	..SEAT AND SEAL ASSEM..............................		EA	1
31	20	XAFZZ		15434	3007514	...SEAT..		EA	1
31	21	PAFZZ	5330-01-052-9988	15434	3007513	...SEAT WATER PUMP SEAL............................		EA	1
31	22	PAOZZ	5305-00-058-6604	15434	182706	..SCREW,CAP,HEXAGON H..............................		EA	1
31	23	PAOZZ	5310-00-763-8920	96906	MS51967-20	..NUT,PLAIN,HEXAGON WATER PUMP IDLER ASSEMBLY HOUSING...		EA	1
31	24	PAOZZ	5310-01-145-0762	15434	213082	..WASHER,FLAT WATER PUMP IDLER ASSEMBLY MOUNTING...		EA	1
31	25	PAOFF	2930-01-096-9199	15434	AR45189	.IDLER ASSEMBLY,WATE PUMP..........................		EA	1
31	26	PAFZZ	5330-01-080-2992	15434	3038998	..SEAL,OIL IDLER SHAFT SPACER TO WATER PUMP HOUSING...		EA	1
31	27	PAFZZ	2815-00-815-0355	15434	S16255	..RING,BEARING RETAINER............................		EA	1

(1) ILLUS-TRATION		(2) SMR CODE	(3) NATIONAL STOCK NUMBER	(4) FSCM	(5) PART NUMBER	(6) DESCRIPTION USABLE ON CODE	(7) U/M	(8) QTY INC IN UNIT
(a) FIG. NO.	(b) ITEM NO.							
						0504(CONT)		
31	28	PAFZZ	5365-01-080-0409	15434	208120	..SPACER IDLER SHAFT	EA	1
31	29	PCFZZ	5330-01-086-3991	15434	145506	..PACKING,PREFORMED IDLER SHAFT TO OIL SEAL PART OF KIT P/N 3018762	EA	1
31	30	PAFZZ	3110-00-144-8828	15434	3010150	..BEARING,BALL IDLER SHAFT MOUNTED	EA	1
31	31	PAFZZ	3040-01-079-3468	15434	208119	..SHAFT,SHOULDERED	EA	1
31	32	PAFZZ	3020-01-079-4206	15434	215397	..PULLEY,IDLER SHAFT MOUNTED	EA	1
31	33	PAOZZ	5305-01-147-4035	15434	3012469	SCREW,CAP,HEXAGON H WATER PUMP AND IDLER ASSEMBLY MOUNTING	EA	2
31	34	PAOZZ	5310-00-261-7340	96906	MS35338-8	WASHER,LOCK	EA	7
31	35	PAOZZ	5305-01-129-4386	15434	3012468	SCREW,CAP,HEXAGON H WATER PUMP AND IDLER ASSEMBLY MOUNTING	EA	5
31	36	PCOZZ	3030-01-065-9404	15434	6702	BELT,V	EA	1
31		PAHZZ	5330-01-092-4143	15434	3018762	KIT,GASKET	EA	1
5	2					GASKET	EA	1
5	4					PACKING,PREFORMED	EA	11
7	5					GASKET	EA	1
9	16					GASKET	EA	V
9	19					GASKET	EA	V
9	20					GASKET	EA	1
11	3					GASKET	EA	1
11	23					PACKING,PREFORMED	EA	1
11	25					GASKET	EA	1
11	43					GASKET	EA	1
11	49					SEAL,RING	EA	1
12	8					GASKET	EA	1
12	22					GASKET	EA	1
13	15					GASKET	EA	1
13	34					GASKET	EA	1
13	42					GASKET	EA	1
14	38					GASKET	EA	1
16	2					GASKET	EA	1
16	13					PACKING,PREFORMED	EA	1
17	16					GASKET	EA	1
25	37					GASKET	EA	1
31	13					GASKET	EA	1
31	17					GASKET	EA	1
31	29					PACKING,PREFORMED	EA	1
31		PAFZZ	5330-01-086-7790	15434	3801350	KIT,GASKET	EA	1
3	19					PACKING,PREFORMED	EA	4
3	33					GASKET	EA	3
8	38					GASKET	EA	3
10	7					GASKET	EA	3
11	30					PACKING,PREFORMED	EA	2
14	4					GASKET	EA	1
14	19					GASKET	EA	1
14	22					GASKET	EA	2
14	23					PACKING,PREFORMED	EA	4
14	27					GASKET	EA	1

(1) ILLUSTRATION (a) FIG. NO.	(1) ILLUSTRATION (b) ITEM NO.	(2) SMR CODE	(3) NATIONAL STOCK NUMBER	(4) FSCM	(5) PART NUMBER	(6) DESCRIPTION USABLE ON CODE	(7) U/M	(8) QTY INC IN UNIT
						0504(CONT)		
14	45					GASKET...	EA	3
15	1					GASKET...	EA	6
15	10					LOCKPLATE..	EA	4
19	19					PACKING,PREFORMED....................................	EA	1
23	6					GASKET...	EA	1
28	5					GASKET...	EA	1
28	11					PACKING,PREFORMED....................................	EA	1
28	16					SEAL...	EA	1
28	18					GASKET...	EA	1
29	1					GASKET...	EA	6
29	4					PACKING,PREFORMED....................................	EA	4
29	13					GASKET...	EA	1
29	15					GASKET...	EA	1

(1) ILLUSTRATION		(2) SMR CODE	(3) NATIONAL STOCK NUMBER	(4) FSCM	(5) PART NUMBER	(6) DESCRIPTION USABLE ON CODE	(7) U/M	(8) QTY INC IN UNIT
(a) FIG. NO.	(b) ITEM NO.							
						GROUP 95-GENERAL USE STANDARDIZED PARTS 9501-BULK MATERIEL		
BULK	1	PAOZZ	4720-00-541-4243	24161	28430	HOSE,NONMETALLIC....................................	FT	V

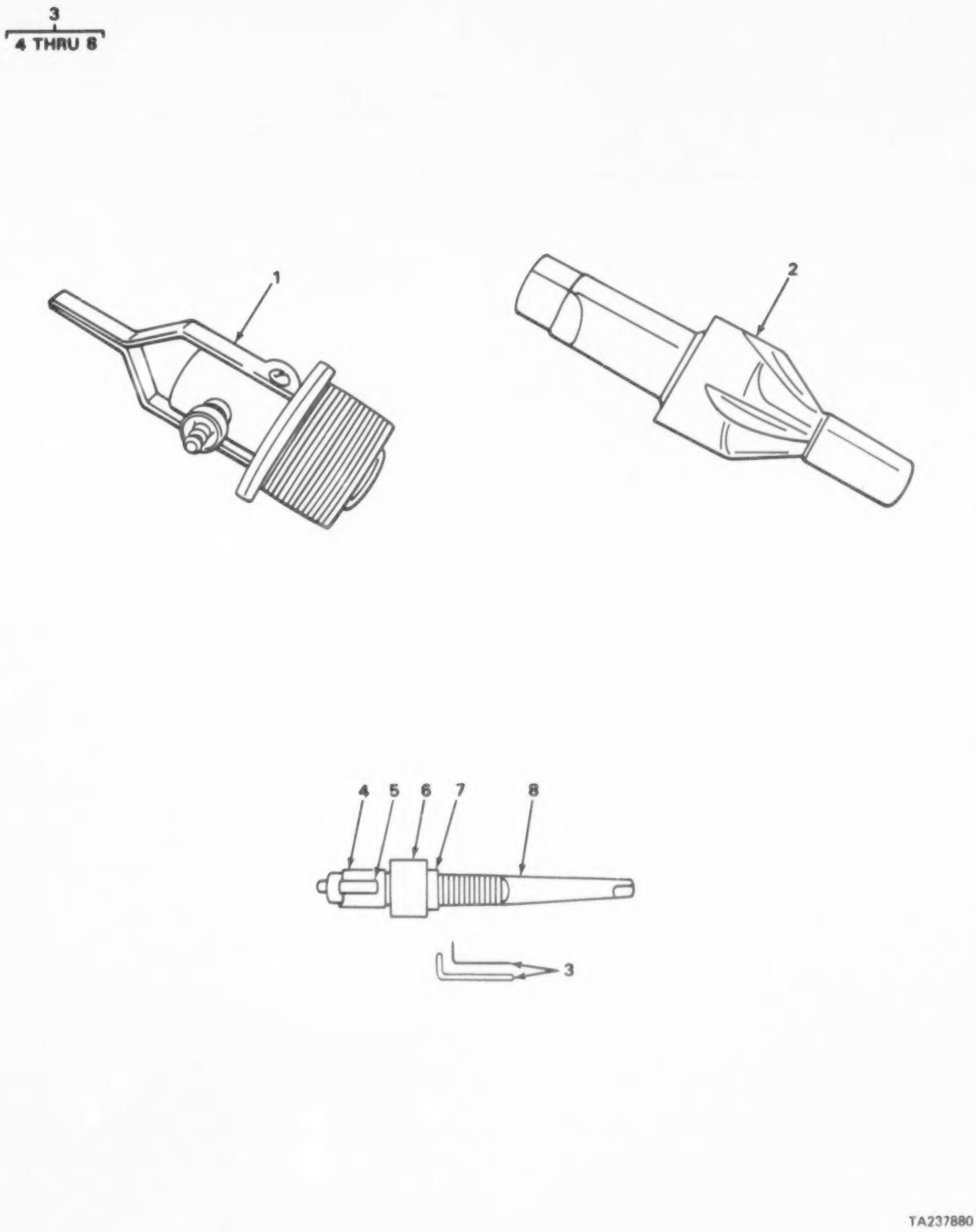
3
4 THRU 8
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FIGURE 32. DIRECT SUPPORT SPECIAL TOOLS (SHEET 1 OF 7)

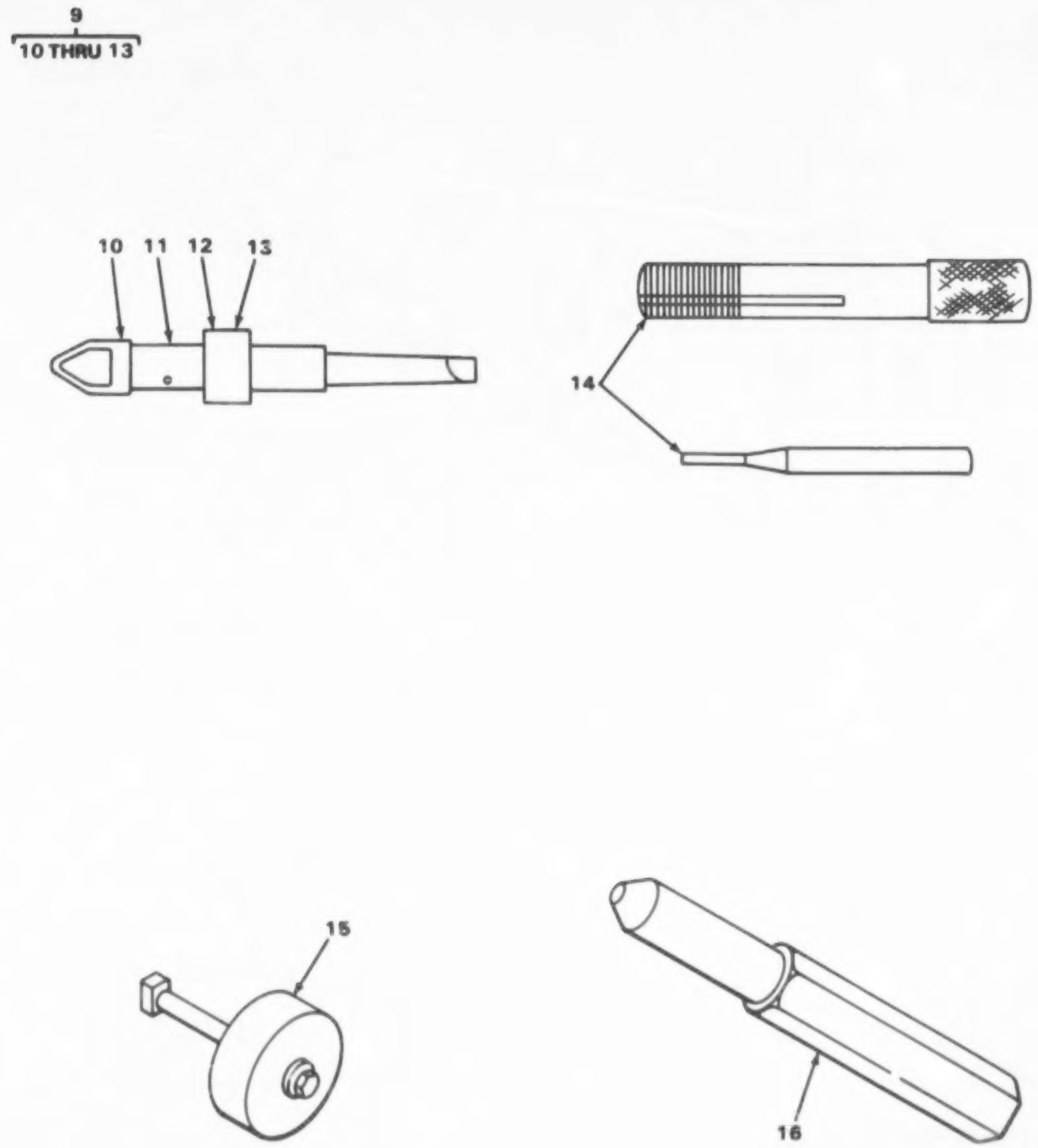
9
10 THRU 13
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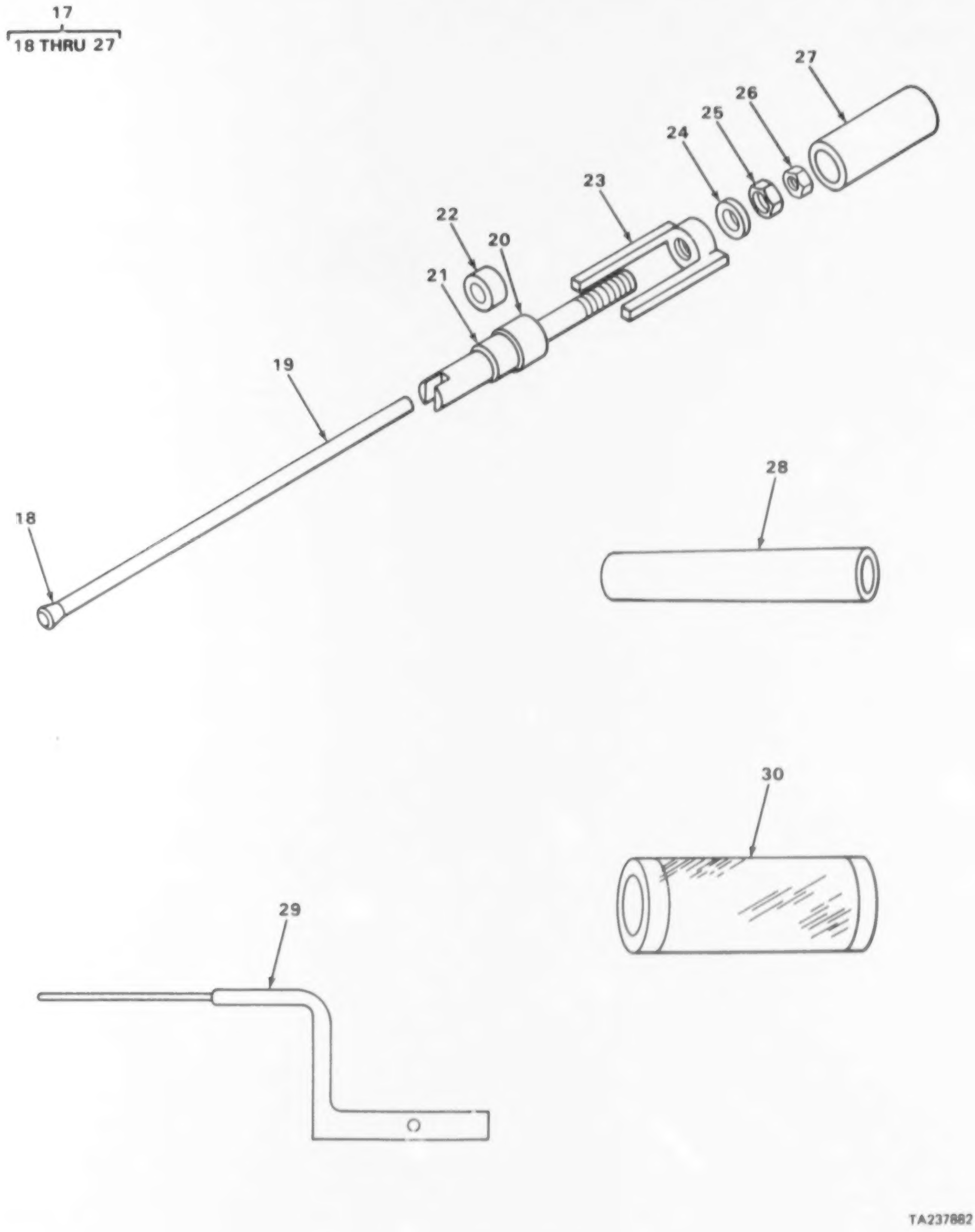
FIGURE 32. DIRECT SUPPORT SPECIAL TOOLS(SHEET 2 OF 7)


17
18 THRU 27
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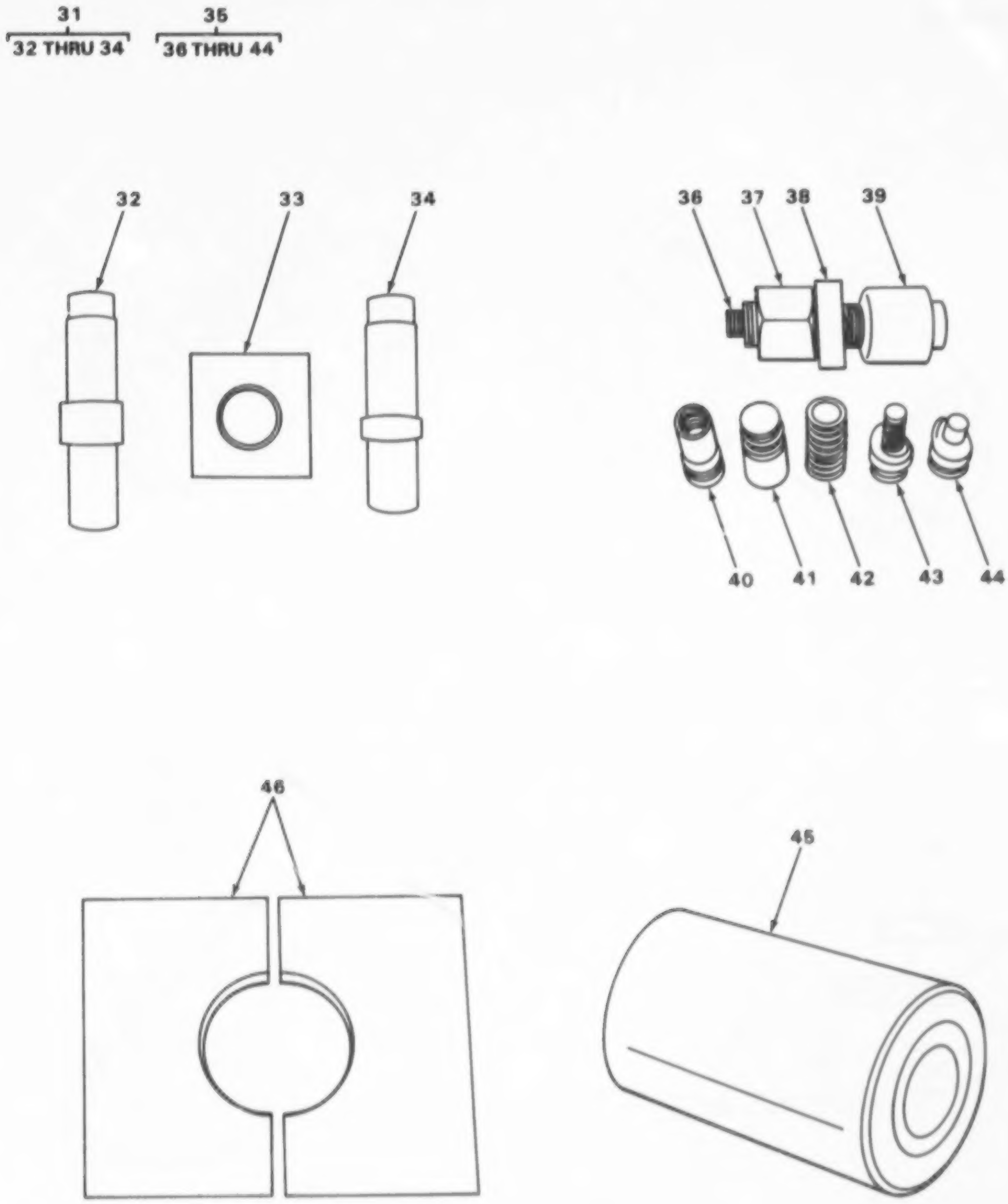
TA237882

FIGURE 32. DIRECT SUPPORT SPECIAL TOOLS (SHEET 3 OF 7)


31
32 THRU 34
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36 THRU 44
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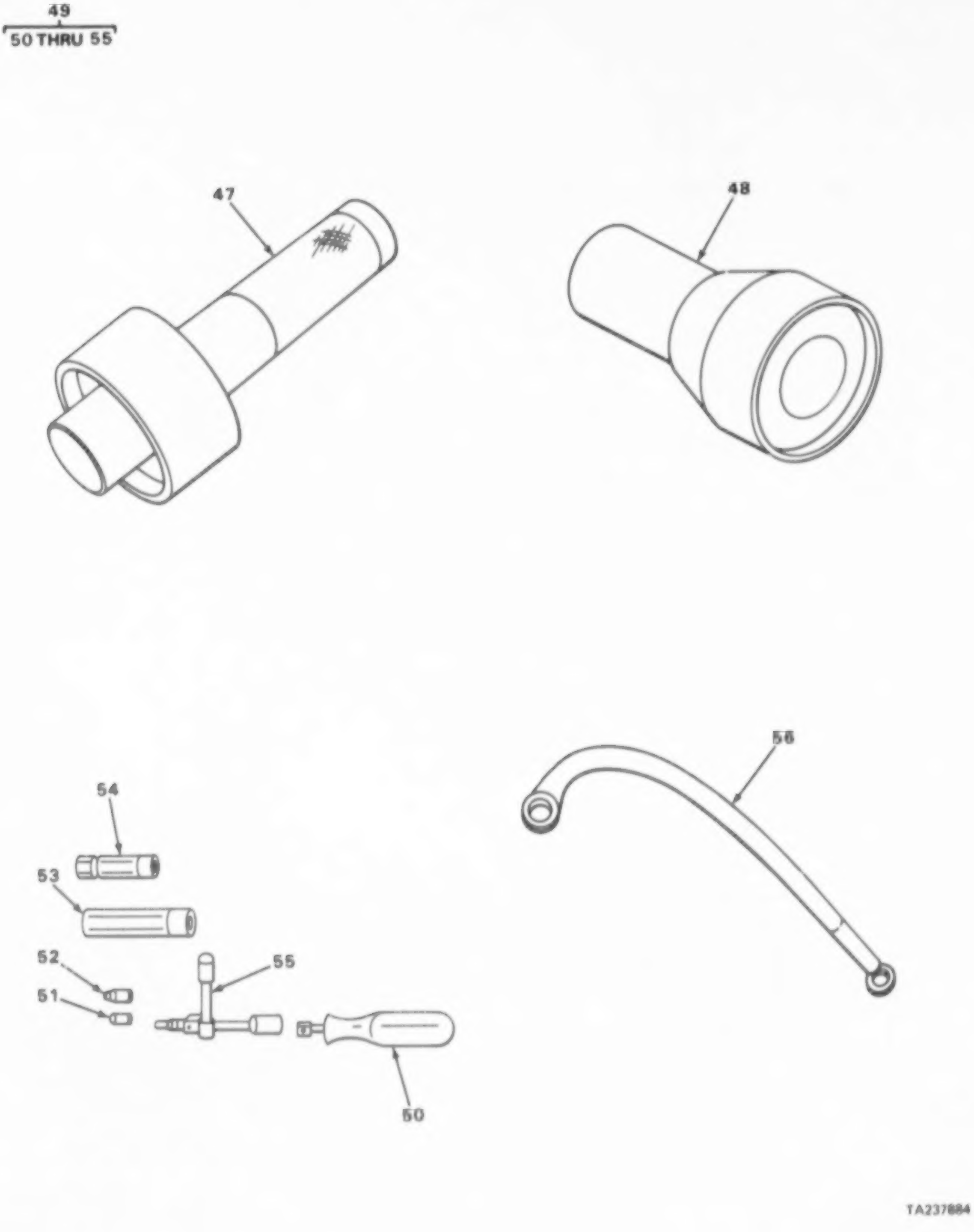
FIGURE 32. DIRECT SUPPORT SPECIAL TOOLS (SHEET 4 OF 7)


49
50 THRU 55
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TA237884

FIGURE 32. DIRECT SUPPORT SPECIAL TOOLS(SHEET 5 OF 7.)

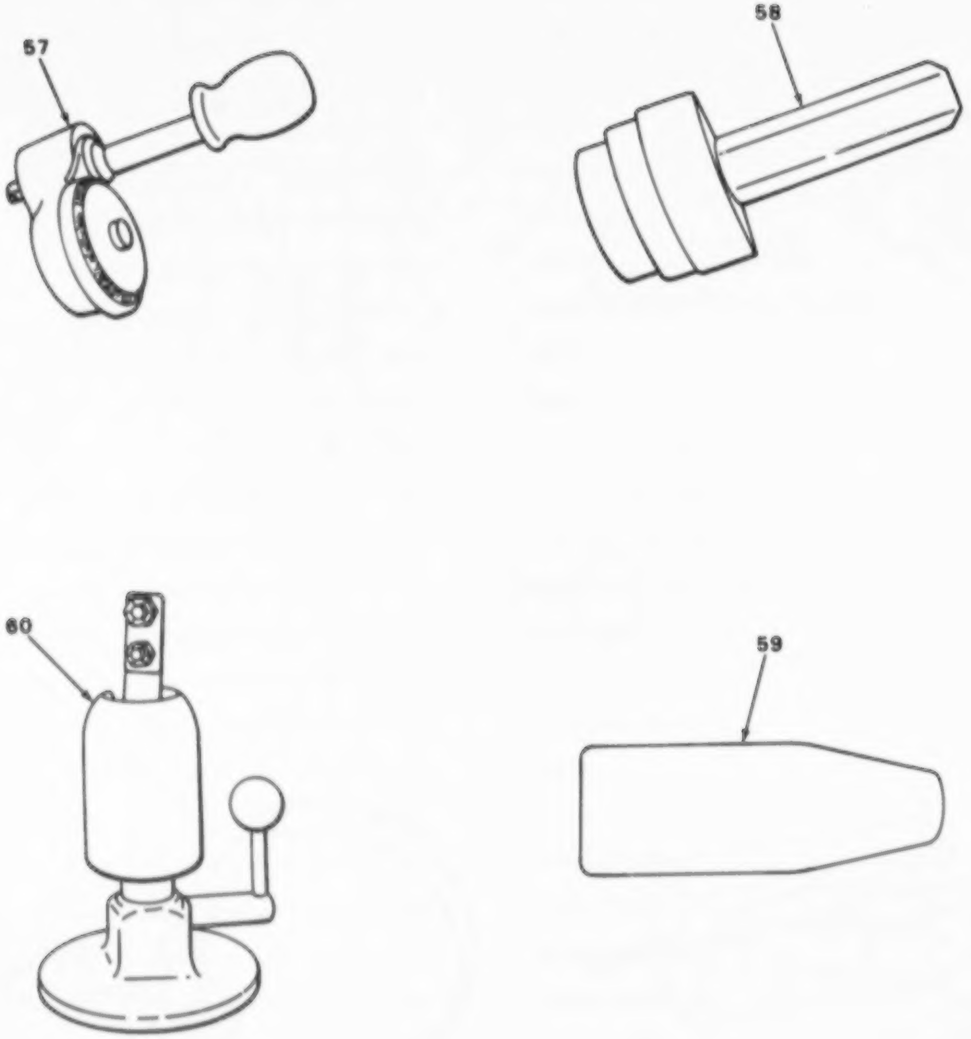

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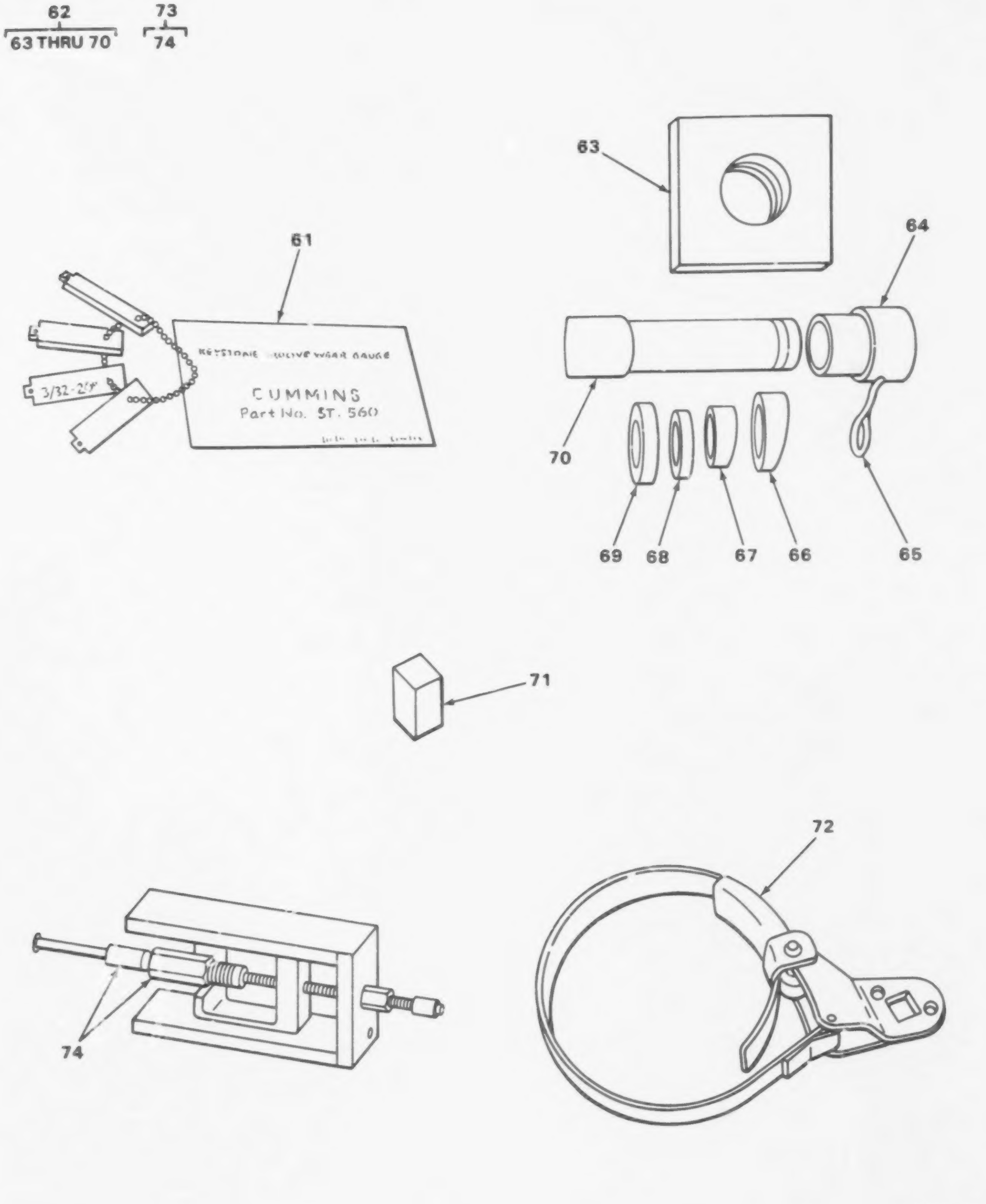
FIGURE 32. DIRECT SUPPORT SPECIAL TOOLS(SHEET 6 OF 7.)


62
63 THRU 70
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64
KEYSTONE VALVE WEAR GAUGE
CUMMINS
Part No. ST. 560
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TA237886

FIGURE 32. DIRECT SUPPORT SPECIAL TOOLS (SHEET 7 OF 7.)

SPECIAL TOOLS AND TEST EQUIPMENT

(1) ILLUS-TRATION		(2)	(3)	(4)	(5)	(6)		(7)	(8)
(a) FIG. NO.	(b) ITEM NO.	SMR CODE	NATIONAL STOCK NUMBER	FSCM	PART NUMBER	DESCRIPTION	USABLE ON CODE	U/M	QTY INC IN UNIT
						GROUP 26-TOOLS AND TEST EQUIPMENT 2604-SPECIAL TOOLS			
32	1	PEFZZ	4910-01-085-9211	15434	3375150	CHECKING TOOL,BLOWB		EA	1
32	2	PEFZZ	5110-00-932-2089	15434	ST788	CUTTING TOOL,BEAD		EA	1
32	3	PEFFF	3441-00-922-6699	15434	ST880	EXPANDER,TUBE,ROLLE		EA	1
32	4	PEFZZ	5210-01-099-6339	15434	ST-880-1	.GAGE		EA	1
32	5	PEFZZ	4910-01-097-6955	15434	ST-880-2	.ROLL		EA	1
32	6	PEFZZ		15434	ST-880-3	.COLLAR		EA	1
32	7	PEFZZ	5310-01-104-4549	15434	ST-880-6	.NUT THRUST		EA	1
32	8	PEFZZ	4910-01-097-6956	15434	ST-880-7	.MANDREL		EA	1
32	9	PEFFF	5910-00-981-3105	15434	ST-884	CUTTER,INJECTOR SLE		EA	1
32	10	PEFZZ	4910-01-098-5088	15434	ST-884-3	.CUTTER		EA	1
32	11	PEFZZ	5910-01-097-6957	15434	ST-884-1	.HOLDER		EA	1
32	12	PEFZZ		15434	ST-884-5	.PILOT 5 1/8'' BORE		EA	1
32	13	PEFZZ	4910-01-097-6958	15434	ST-884-6	.PILOT 5 1/2'' BORE		EA	1
32	14	PEFZZ	4910-00-150-5858	15434	3375425	EXTRACTOR,SLEEVE IN		EA	1
32	15	PEFZZ	5120-00-104-1795	15434	ST-1179	HOLDING TOOL,INJECT SLEEVE		EA	1
32	16	PEFZZ	5120-00-981-3108	15434	ST-1227	DRIVER INJECTOR SLEEVE		EA	1
32	17	PEFFF	5120-00-113-5271	15434	ST-1244	EXTRACTOR,SLEEVE		EA	1
32	18	PEFZZ	4910-01-097-6970	15434	3375825	.TIP EXTRACTOR		EA	1
32	19	PEFZZ	5120-01-120-3682	15434	3375616	.ROD		EA	1
32	20	PEFZZ		15434	3375615	.COLLAR		EA	1
32	21	PEFZZ	4910-01-097-6969	15434	3375614	.COLLAR FORMING		EA	1
32	22	PEFZZ	5365-01-103-7835	15434	ST-1244-9	.SPACER,RING		EA	1
32	23	PEFZZ	5120-01-100-0137	15434	ST-1244-1	.BRIDGE,SUPPORT		EA	1
32	24	PEFZZ	3120-01-103-8752	15434	ST-1244-5	.BEARING,WASHER,THRU		EA	1
32	25	PEFZZ	5310-01-104-4550	15434	ST-1244-4	.NUT 1-8 THREAD		EA	1
32	26	PEFZZ		15434	ST-1244-3	.NUT 9/16-12 THREAD		EA	1
32	27	PEFZZ	5120-01-099-6341	15434	ST-1244-8	.DRIVER		EA	1
32	28	PEFZZ	4910-01-097-6971	15434	3375282	DRIVER VALVE GUIDE		EA	1

(1) ILLUS-TRATION (a) FIG. NO.	(1) ILLUS-TRATION (b) ITEM NO.	(2) SMR CODE	(3) NATIONAL STOCK NUMBER	(4) FSCM	(5) PART NUMBER	(6) DESCRIPTION USABLE ON CODE	(7) U/M	(8) QTY INC IN UNIT
						2604(CONT)		
32	29	PEFZZ	4910-01-097-6972	15434	ST-1325	ATTACHMENT DIAL GAGE	EA	1
32	30	PEFZZ	4910-00-150-5797	15434	ST-633	HEAD,GUIDE,SPACER	EA	1
32	31	PEFFF	3460-00-999-1210	15434	ST-691	MANDREL SET MACHINE	EA	1
32	32	PEFZZ	4910-01-097-6973	15434	ST-691-1	.MANDREL	EA	1
32	33	PEFZZ	4910-01-097-6974	15434	ST-691-2	.BLOCK	EA	1
32	34	PEFZZ	4910-01-097-6975	15434	ST-691-3	.MANDREL	EA	1
32	35	PEFFF	5180-00-944-0374	15434	ST-386	PULLEY ASSEMBLY,TOO	EA	1
32	36	PEFZZ	4910-01-097-6977	15434	ST-386-2	.ARBOR	EA	1
32	37	PEFZZ	4910-01-097-6978	15434	ST-386-3	.NUT	EA	1
32	38	PEFZZ	4910-01-097-6984	15434	ST-386-11	.BALL THRUST BEARING	EA	1
32	39	PEFZZ	4910-01-097-6979	15434	ST-386-5	.SPACER	EA	1
32	40	PEFZZ	4910-01-097-6985	15434	3375205	.ADAPTER	EA	1
32	41	PEFZZ	4910-01-097-6983	15434	ST-386-10	.ADAPTER 2-1/4 IN. X 7/8 IN. DIA	EA	1
32	42	PEFZZ	4910-01-097-6982	15434	ST-386-9	.ADAPTER 2-1/4 IN. X 1 IN. DIA	EA	1
32	43	PEFZZ	4910-01-097-6981	15434	ST-386-8	.ADAPTER 2-1/4 IN. X 1 IN. DIA	EA	1
32	44	PEFZZ	4910-01-097-6980	15434	ST-386-6	.ADAPTER 1-7/8 IN. X 1 IN. DIA	EA	1
32	45	PEFZZ	4910-01-097-6986	15434	ST-658	MANDREL WATER PUMP SEAL	EA	1
32	46	PEFZZ	4910-01-097-6987	15434	ST-1114	FIXTURE BEARING DISASSEMBLY	EA	1
32	47	PEFZZ	4910-01-097-6988	15434	ST-1159	WATER PUMP SEAL DRIVER	EA	1
32	48	PEFZZ	4910-01-097-6989	15434	3375180	DRIVER WATER PUMP DRIVE SHAFT OIL SEAL	EA	1
32	49	FEFFF	5120-00-103-4687	15434	ST-669	ADAPTER,TORQUE WREN	EA	1
32	50	PEFZZ	5120-00-288-6514	81348	F-40A	.HANDLE,SOCKET WRENC 3/8 IN., PLASTIC HANDLE	EA	1
32	51	PEFZZ	5120-01-122-6014	15434	ST-669-13	.SCREWDRIVER BIT 1/2 IN. X 0.062 IN	EA	1
32	52	PEFZZ	5120-00-865-0226	15434	TM-82	.BIT,SCREWDRIVER 1/4 IN. X 0.032 IN	EA	1
32	53	PEFZZ	5120-01-091-0690	15434	M-1302B-24	.SOCKET,SOCKET WRENC 3/4 IN. DEEP DOUBLE HEX	EA	1
32	54	PEFZZ	5120-01-091-0689	15434	M1302B18	.SOCKET,SOCKET WRENC 9/16 IN. DEEP DOUBLE HEX	EA	1
32	55	PEFZZ	5120-01-099-6340	15434	ST-6991	.DRIVER HANDLE ASSEM	EA	1
32	56	PEFZZ	5120-01-072-2952	15434	3375159	WRENCH,BOX AIR COMPRESSOR	EA	1
32	57	PEFZZ	4910-01-097-6929	15434	3375232	WRENCH,STRAP TORQUE INCH POUND	EA	1

(1) ILLUSTRATION (a) FIG. NO.	(1) ILLUSTRATION (b) ITEM NO.	(2) SMR CODE	(3) NATIONAL STOCK NUMBER	(4) FSCM	(5) PART NUMBER	(6) DESCRIPTION	USABLE ON CODE	(7) U/M	(8) QTY INC IN UNIT
						2604(CONT)			
32	58	PEOZZ	4910-01-097-6948	15434	ST1225	MANDREL,SEAL,THERMO		EA	1
32	59	PEFZZ	5120-00-896-8097	15434	ST-419	FRONT SEAL ASSEMBLY		EA	1
32	60	PEFZZ	4910-00-999-1506	15434	ST-302	VISE,BALL JOINT		EA	1
32	61	PEFZZ	5120-00-999-1209	15434	ST-560	GAGE,GROOVE WEAR		EA	1
32	62	PEFFF	4910-01-098-1914	15434	ST-1242	PARTS KIT BUSHING D		EA	1
32	63	PEFZZ	4910-01-112-7509	15434	ST-1242-3	.TOOL,EMBEDDING BLOC		EA	1
32	64	PEFZZ	4910-01-113-1066	15434	ST-1242-2	.CUP,BUSHING DRIVER		EA	1
32	65	PEFZZ	5315-01-110-7835	15434	ST-1242-6	.PIN,COTTER		EA	1
32	66	PEFZZ	5120-01-119-2743	15434	ST-1242-4	.DRIVER,BEARING AND TAPERED		EA	1
32	67	PEFZZ	4910-01-099-1487	15434	ST-1242-5	.KNOCKOUT RING TAPE		EA	1
32	68	PEFZZ	4910-01-117-4885	15434	ST-1242-7	.RING,KNOCKOUT STRAIGHT		EA	1
32	69	PEFZZ	4910-01-118-2878	15434	ST-1242-8	.DRIVER,BEARING AND STRAIGHT		EA	1
32	70	PEFZZ	4910-01-108-9130	15434	ST-1242-1	.MANDREL		EA	1
32	71	PEFZZ	5120-00-150-7492	15434	ST-995	WRENCH,INJECTION		EA	1
32	72	PEOZZ	5120-01-160-8863	15434	3375049	WRENCH,STRAP OIL & FUEL FILTER,SPIN ON		EA	1
32	73	PEFFF	5120-00-999-1504	15434	ST-709	PULLER,MECHNICAL		EA	1
32	74	PEFZZ	4810-01-097-6930	15434	3375108	.PULLER BUSHING		EA	1

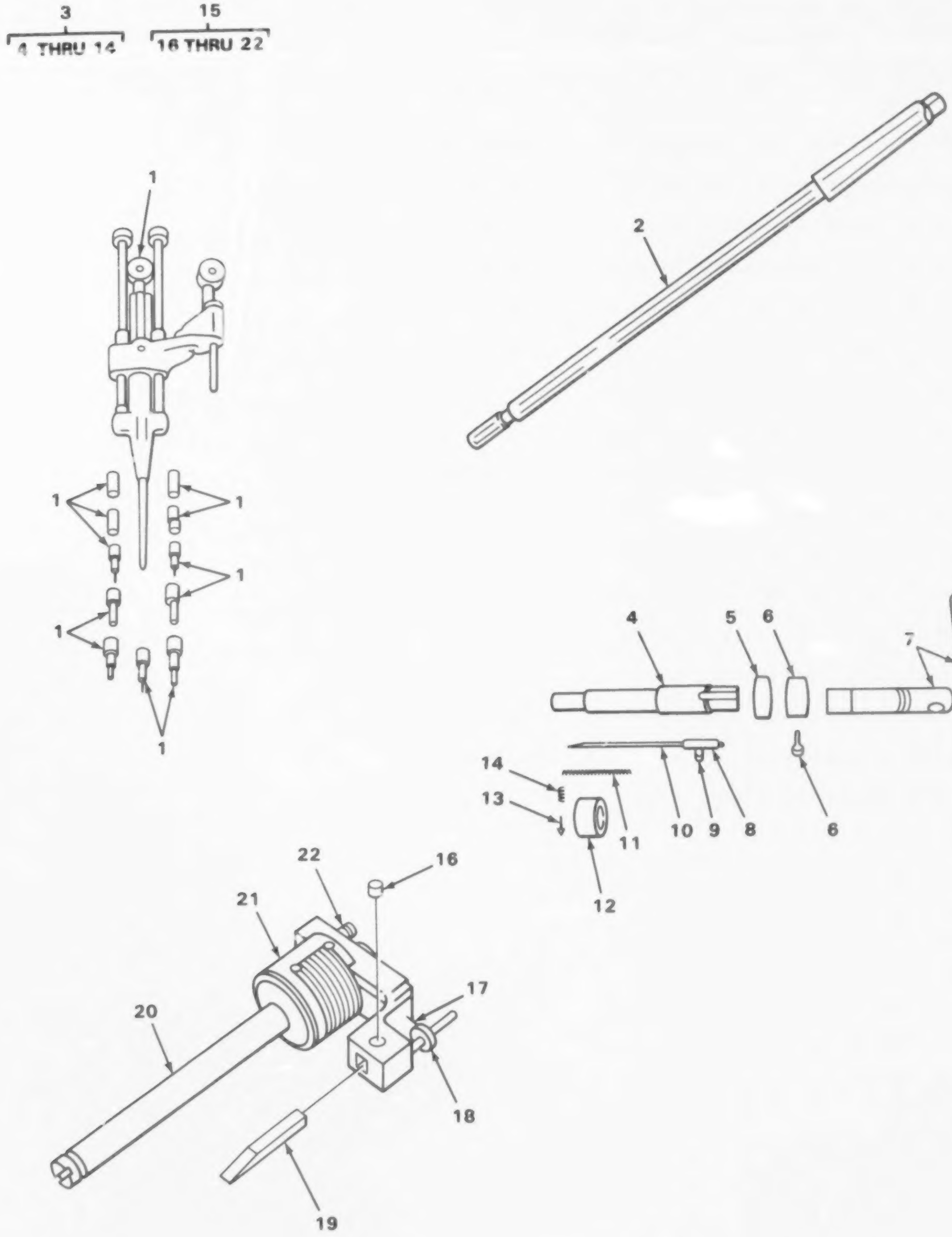
3
4 THRU 14
15
16 THRU 22
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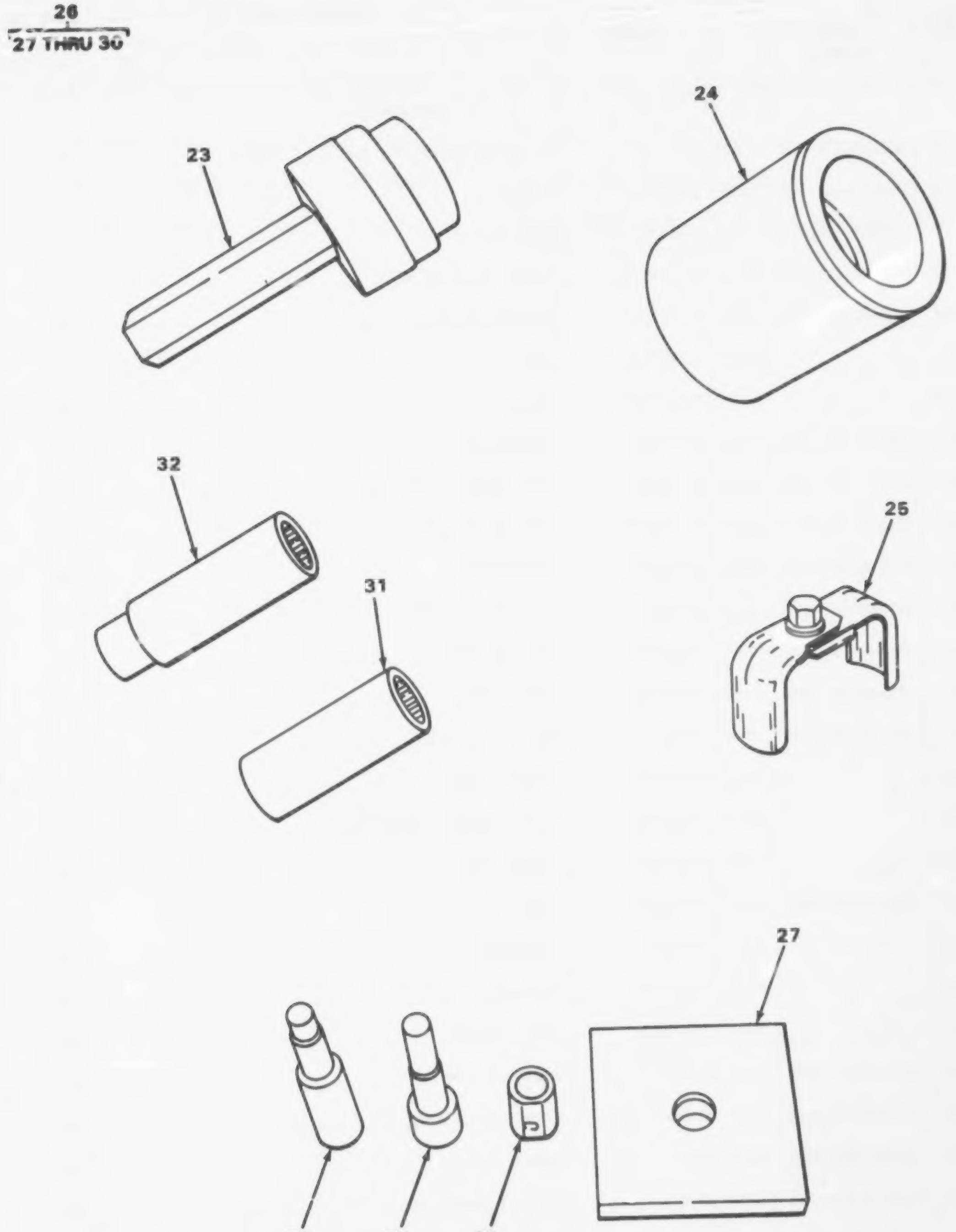
FIGURE 33. DIRECT SUPPORT SPECIAL TOOLS (SUPPLEMENTAL)(SHEET 1 OF 2).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27 THRU 30
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FIGURE 33. DIRECT SUPPORT SPECIAL TOOLS (SUPPLEMENTAL) (SHEET 2 OF 2)

(1) ILLUSTRATION		(2)	(3)	(4)	(5)	(6)		(7)	(8)
(a) FIG. NO.	(b) ITEM NO.	SMR CODE	NATIONAL STOCK NUMBER	FSCM	PART NUMBER	DESCRIPTION	USABLE ON CODE	U/M	QTY INC IN UNIT
						2604(CONT)			
33	1	PEFZZ	4910-00-712-0537	15434	ST-593	INDICATOR,ENGINE TI INJECTOR TIMING................		EA	1
33	2	PEFZZ	5110-00-980-7347	15434	ST-646	REAMER...		EA	1
33	3	PEFFF	5120-00-178-0948	15434	ST-1100	TOOL,GROOVING......................................		EA	1
33	4	PEFZZ	4910-01-097-6964	15434	ST-1100-10	.BODY 5-1/2 IN. BORE...............................		EA	1
33	5	PEFZZ	4910-01-097-6961	15434	ST-1100-7	.NUT,ADJUSTING.....................................		EA	1
33	6	PEFZZ		15434	ST-1100-5	.NUT...		EA	1
33	7	PEFZZ		15434	ST-1100-1	.BODY..		EA	1
33	8	PEFZZ	4910-01-097-6962	15434	ST-1100-8	.SLEEVE ROD..		EA	1
33	9	PEFZZ	4910-01-097-6960	15434	ST-1100-6	.CAP SCREW 1/4-28 X 3/16 IN........................		EA	1
33	10	PEFZZ	4910-01-097-6965	15434	ST-1100-11	.ROD TOOL ADJUSTING................................		EA	1
33	11	PEFZZ	4910-01-097-6963	15434	ST-1100-9	.SPRING ROD..		EA	1
33	12	PEFZZ	4910-01-097-6968	15434	ST-1100-14	.CAP,TOOL SETTING..................................		EA	1
33	13	PEFZZ	4910-01-097-6967	15434	ST-1100-13	.CUTTING TOOL......................................		EA	1
33	14	PEFZZ	4910-01-097-6966	15434	ST-1100-12	.SPRING TOOL.......................................		EA	1
33	15	PEFFF	4910-00-999-1499	15434	ST-913	TOOL,CYLINDER HEAD.................................		EA	1
33	16	PEFZZ		15434	ST-913-18	.INSERT,FIBER......................................		EA	4
33	17	PEFZZ		15434	ST-913-23	.SCREW,ASSEMBLY ADJUSTING..........................		EA	1
33	18	PEFZZ		15434	ST-913-14	.HOLDER,TOOL.......................................		EA	1
33	19	PEFZZ	4910-01-097-6959	15434	ST-913-17	.TOOL BIT..		EA	1
33	20	PEFZZ		15434	ST-913-1	.LOCKSCREW...		EA	1
33	21	PEFZZ		15434	ST-913-7	.BEARING...		EA	1
33	22	PEFZZ		15434	ST-913-11	.PLUG,LOCKING......................................		EA	1
33	23	PEFZZ	4910-01-097-6976	15434	ST-1218	MANDREL O RING.....................................		EA	1
33	24	PEFZZ	5120-00-159-8916	15434	ST-659	MANDREL,WATER PUMP SEAL............................		EA	1
33	25	PEFZZ	5120-00-865-0933	93389	2304	REMOVAL TOOL,OIL FI		EA	1
33	26	PEFFF	5180-00-916-1813	15434	ST-249	TOOL KIT,DIESEL INJ................................		EA	1
33	27	PEFZZ		15434	ST-249-4	.BLOCK...		EA	1
33	28	PEFZZ	5120-01-106-9174	15434	ST-249-3	.SLEEVE,MANDREL....................................		EA	1
33	29	PEFZZ	5120-01-097-3204	15434	ST-249-2	.MANDREL...		EA	1

(1) ILLUSTRATION		(2) SMR CODE	(3) NATIONAL STOCK NUMBER	(4) FSCM	(5) PART NUMBER	(6) DESCRIPTION USABLE ON CODE	(7) U/M	(8) QTY INC IN UNIT
(a) FIG. NO.	(b) ITEM NO.							
						2604(CONT)		
33	30	PEFZZ	5120-01-106-9173	15434	ST-249-1	.MANDREL...	EA	1
33	31	PEFZZ	5120-01-093-3382	55719	B1465A	SOCKET,SOCKET WRENC JACOBS BRAKE..................	EA	1
33	32	PEFZZ	5120-01-092-3275	55719	STMD-8	SOCKET,SOCKET WRENC 1/4 IN. 12 POINT, 1/4 IN. DRIVE..	EA	1

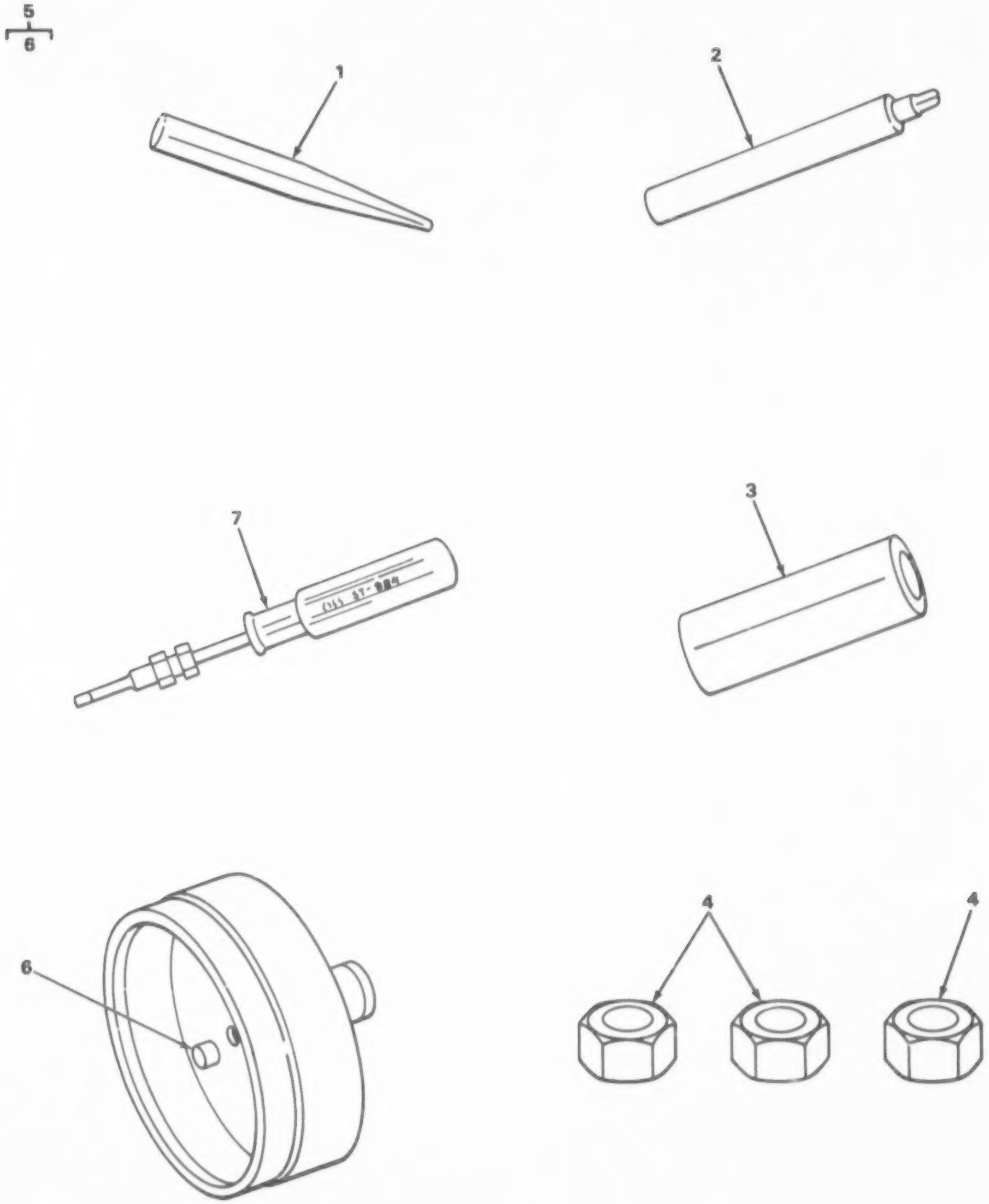
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FIGURE 34. GENERAL SUPPORT COMMON TOOLS (SHEET 1 OF 8)

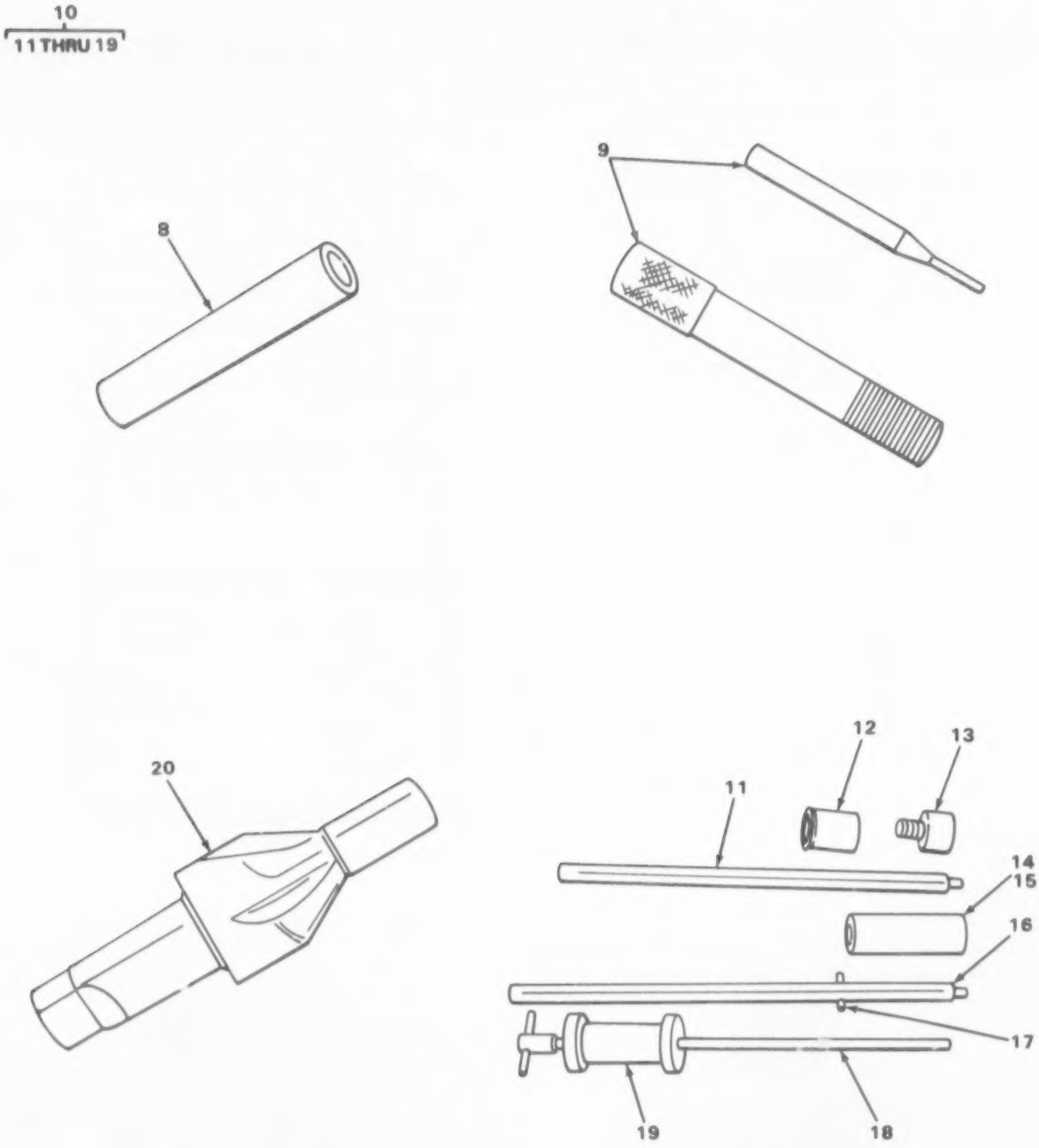
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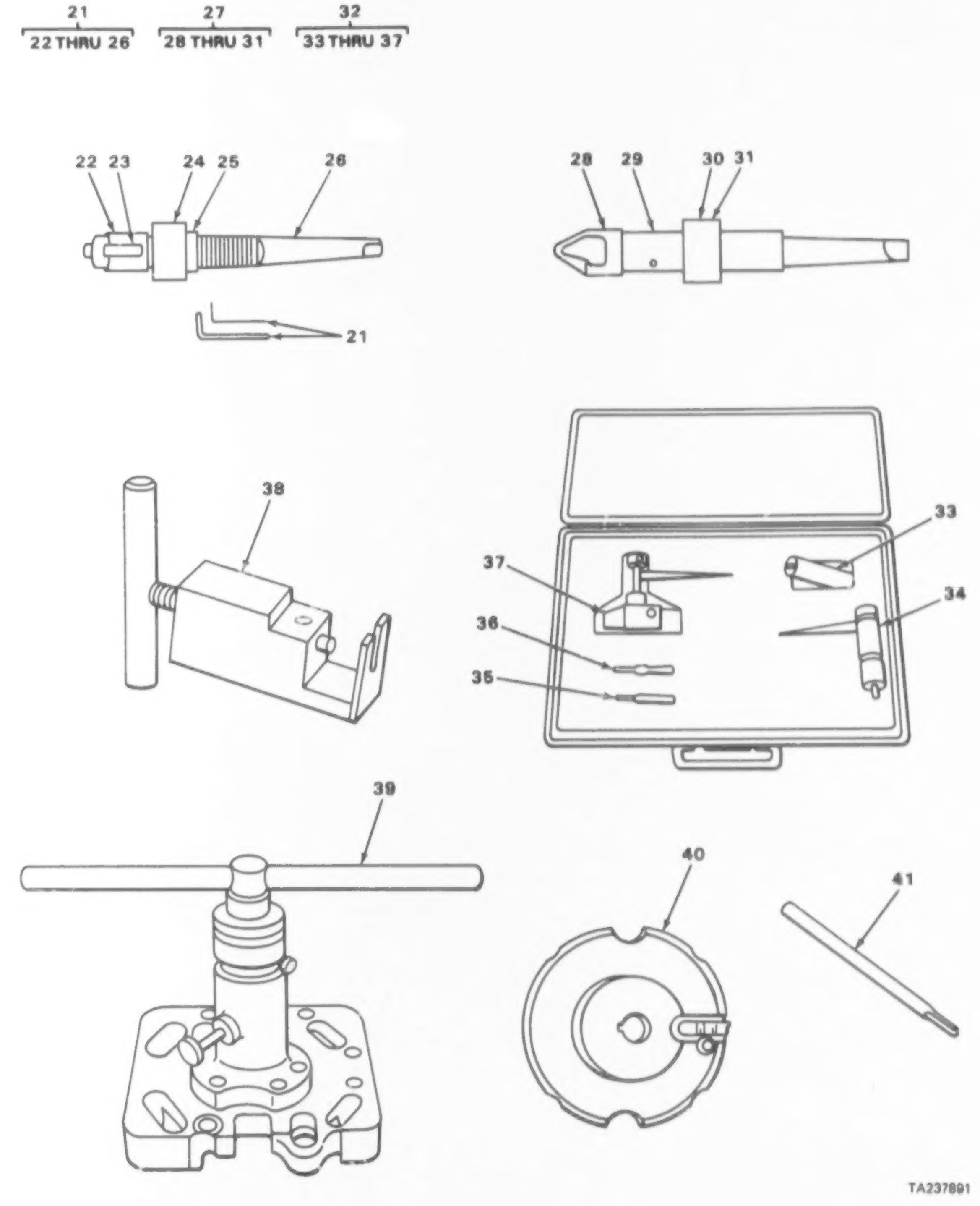
FIGURE 34. GENERAL SUPPORT COMMON TOOLS(SHEET 2 OF 8)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22 THRU 26
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28 THRU 31
32
33 THRU 37
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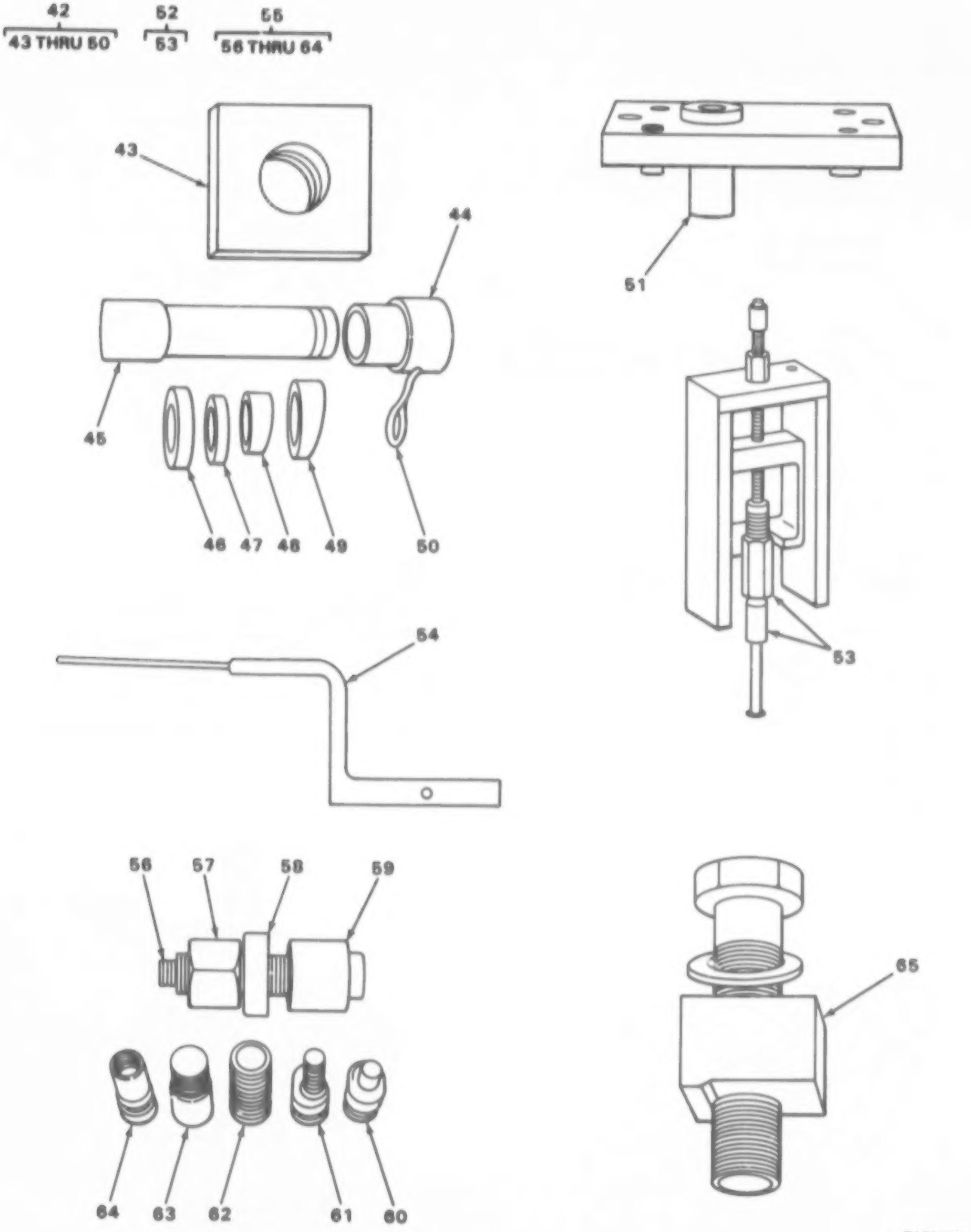
FIGURE 34. GENERAL SUPPORT COMMON TOOLS(SHEET 3 OF 8)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43 THRU 50
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56 THRU 64
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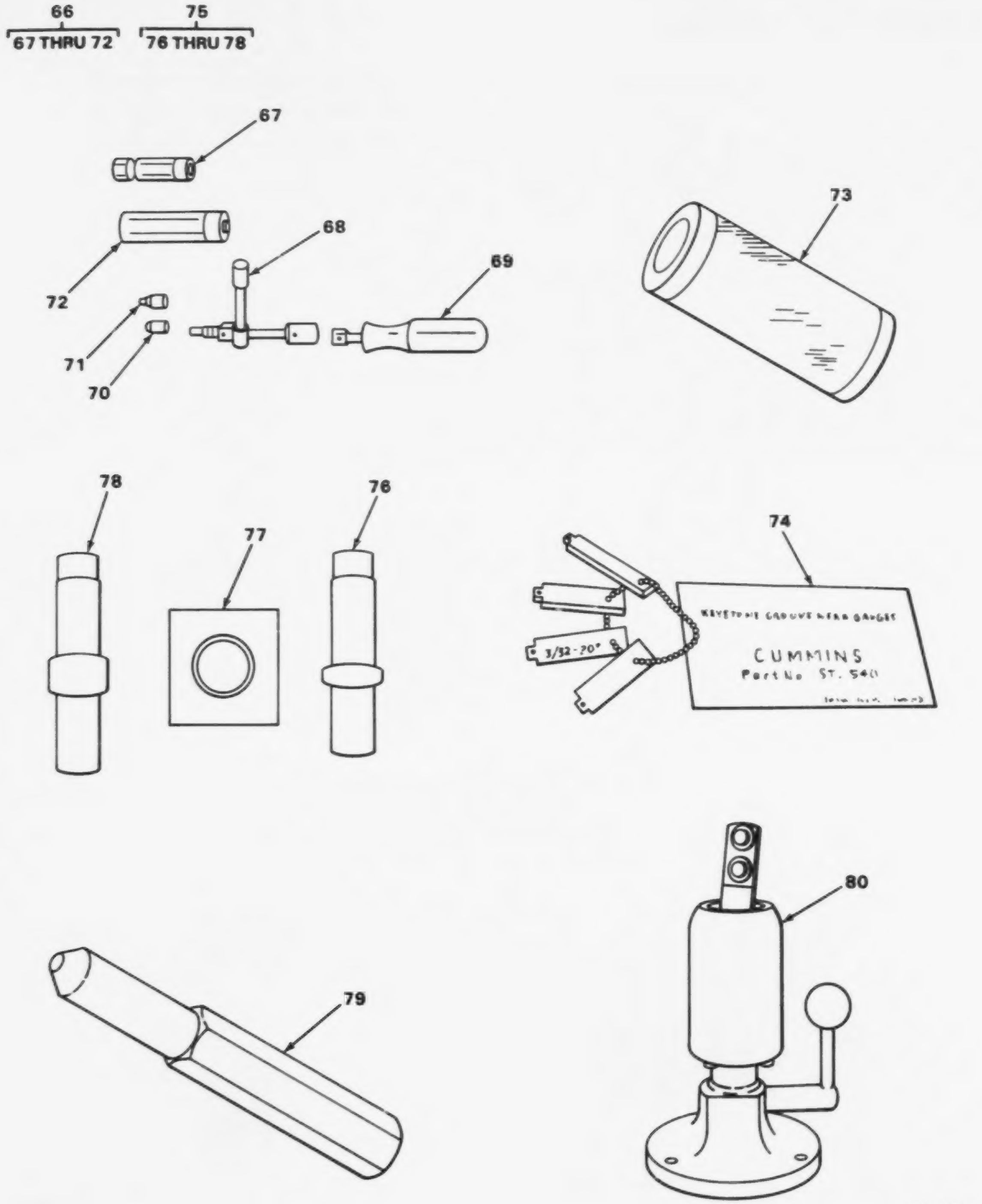
FIGURE 34. GENERAL SUPPORT COMMON TOOLS(SHEET 4 OF 8)


66
67 THRU 72
75
76 THRU 78
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72
71
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74
KEYSTONE GROOVE WEAR GAUGES
CUMMINS
Part No ST. 541
3/32-20°
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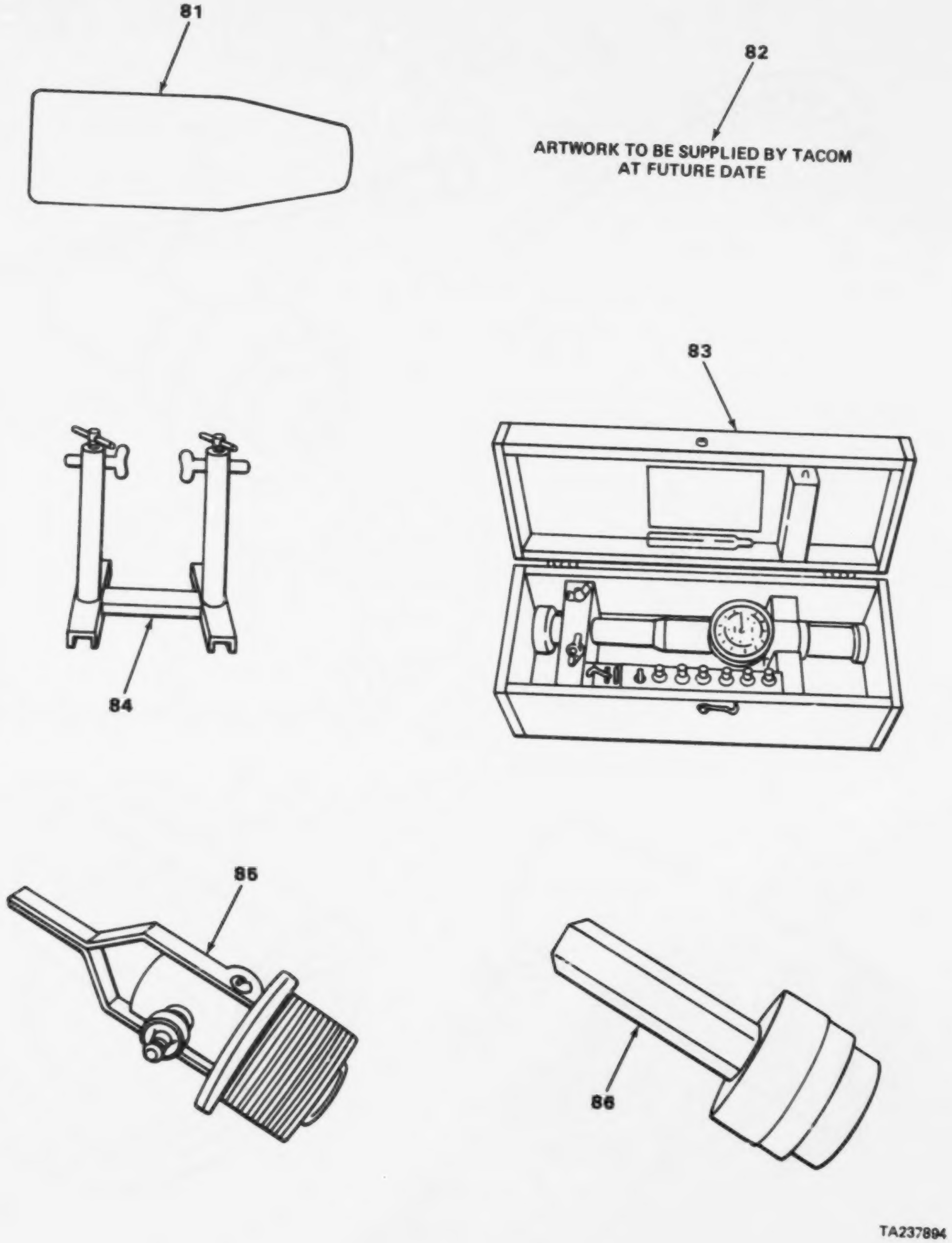
FIGURE 34. GENERAL SUPPORT COMMON TOOLS (SHEET 5 OF 8)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82
ARTWORK TO BE SUPPLIED BY TACOM
AT FUTURE DATE
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FIGURE 34. GENERAL SUPPORT COMMON TOOLS (SHEET 6 OF 8.)

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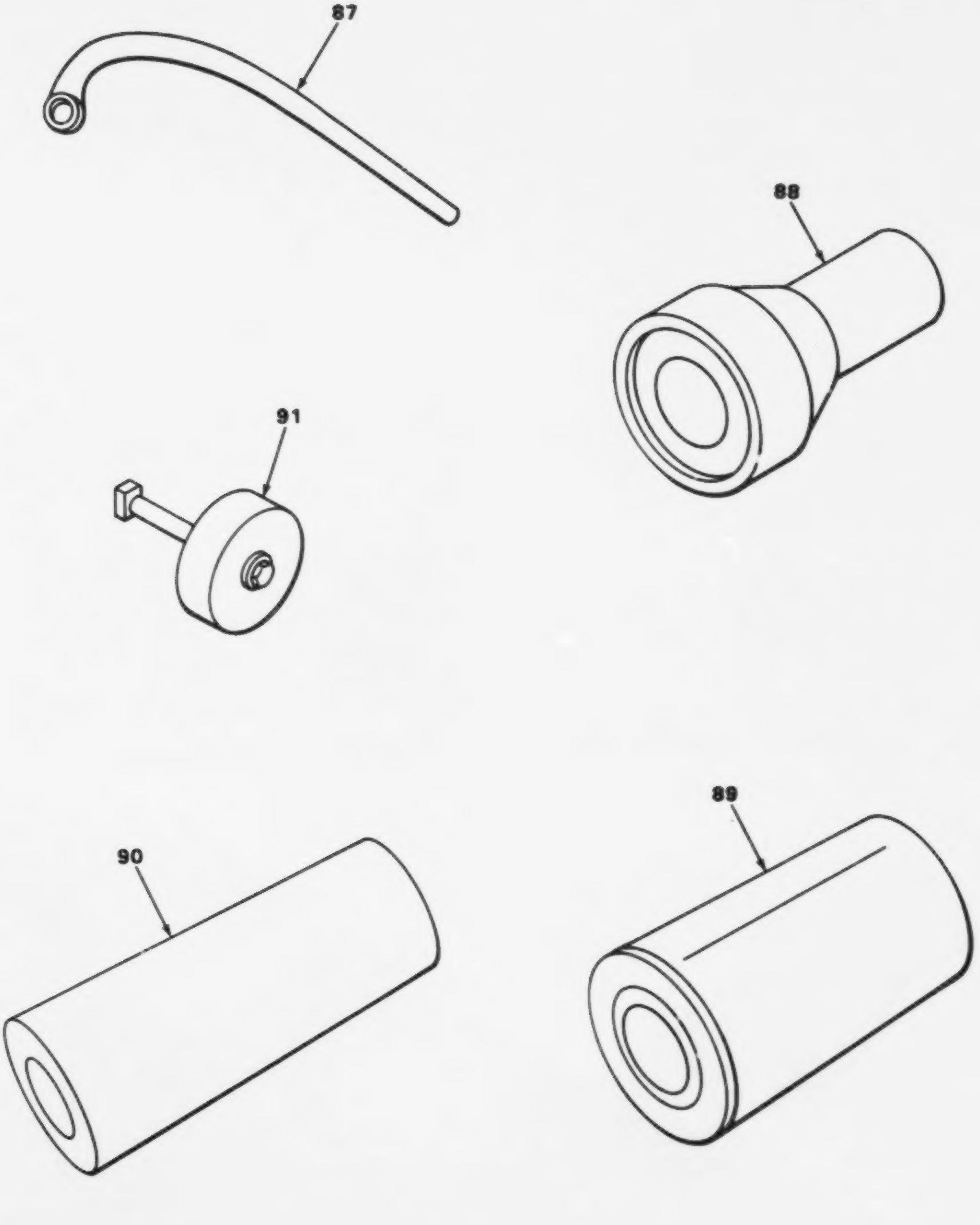
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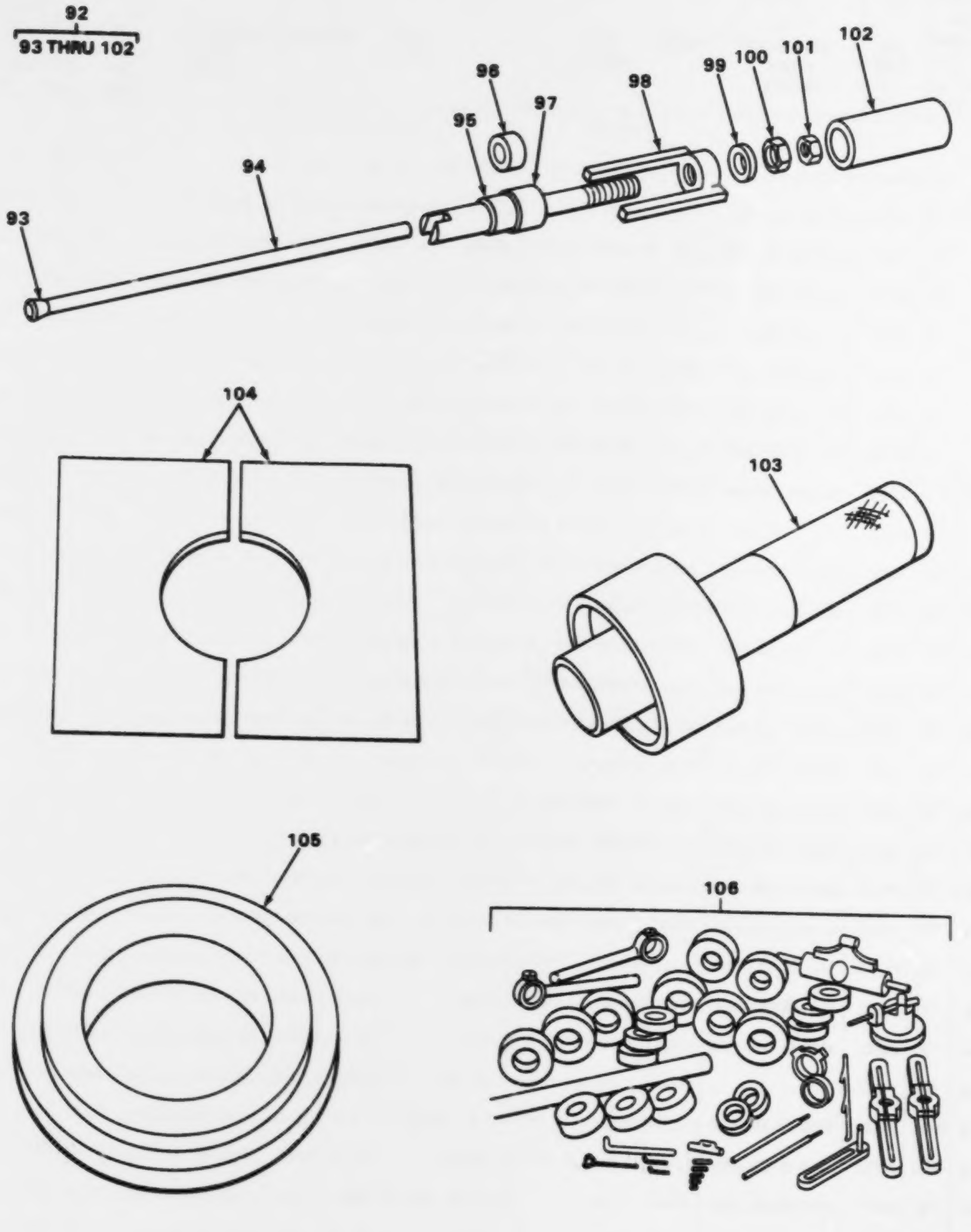
FIGURE 34. GENERAL SUPPOFT COMMON TOOLS(SHEET 7 OF 8.)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93 THRU 102
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TA237896

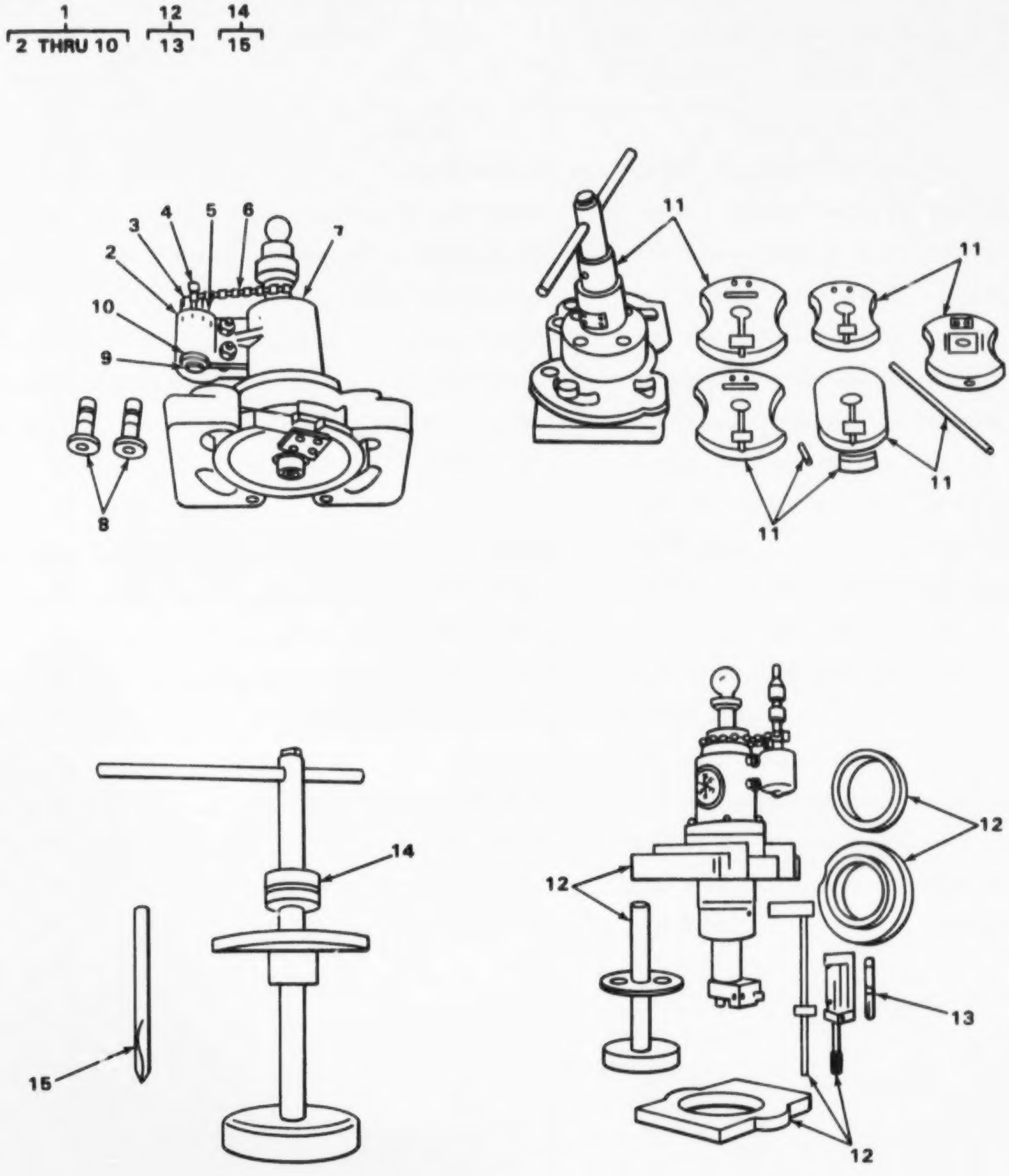
FIGURE 34. GENERAL SUPPORT COMMON TOOLS (SHEET 8 OF 8.)

(1) ILLUSTRATION (a) FIG. NO.	(1) ILLUSTRATION (b) ITEM NO.	(2) SMR CODE	(3) NATIONAL STOCK NUMBER	(4) FSCM	(5) PART NUMBER	(6) DESCRIPTION USABLE ON CODE	(7) U/M	(8) QTY INC IN UNIT
						2604(CONT)		
34	1	PEHZZ	5120-00-999-1505	15434	ST-835	INSTALLING TOOL,TUB	EA	1
34	2	PEHZZ	4910-00-150-5801	15434	ST-853	DRIVER,GOVERNOR,CYL	EA	1
34	3	PEHZZ	5120-00-896-8087	15434	ST-1032	ASSEMBLY TOOL,TACHO	EA	1
34	4	PEHZZ	5120-00-150-7492	15434	ST-995	WRENCH,INJECTION	EA	1
34	5	PEHHH	4910-00-150-5810	15434	ST-997	DRIVER,SEAL CRANKSH	EA	1
34	6	PEHZZ	4910-01-097-6915	15434	ST-997-6	.PINS	EA	2
34	7	PEHZZ	4910-00-150-5805	15434	3375981	ADJUSTING TOOL	EA	1
34	8	PEFZZ	4910-01-097-6971	15434	3375282	DRIVER VALVE GUIDE	EA	1
34	9	PEFZZ	4910-00-150-5858	15434	3375425	EXTRACTOR,SLEEVE IN	EA	1
34	10	PEHHH	5120-00-055-4013	15434	ST-1228	MANDREL,CAMSHAFT BU	EA	1
34	11	PEHZZ	4910-01-098-1917	15434	ST-1228-3	.MANDREL SHANK BUSHI	EA	1
34	12	PEHZZ	4910-01-100-6191	15434	ST-1228-9	.DRIVER	EA	1
34	13	PEHZZ	4910-01-097-6910	15434	ST-1228-13	.PULLER ASSEMBLY BUS	EA	1
34	14	PEHZZ	4910-01-098-1919	15434	ST-1228-5	.GUIDE BUSHING DRIVE	EA	1
34	15	PEHZZ	4910-01-097-6912	15434	3375154	.GUIDE 2-1/2 IN	EA	1
34	16	PEHZZ	4910-01-098-1918	96906	ST-1228-4	.SHAFT ASSEMBLY	EA	1
34	17	PEHZZ	4910-01-097-6911	15434	ST-1228-14	.ROLL PIN	EA	1
34	18	PEHZZ	4910-01-098-1916	15434	ST-1228-2	.ROD BUSHING DRIVER	EA	1
34	19	PEHZZ	4910-01-098-1915	15434	ST-1228-1	.HAMMER SLIDE	EA	1
34	20	PEFZZ	5110-00-932-2089	15434	ST-788	CUTTING TOOL,BEAD INJECTOR SLEEVE	EA	1
34	21	PEFFF	3441-00-922-6699	15434	ST-880	EXPANDER TUBE ROLLE	EA	1
34	22	PEFZZ	5210-01-099-6339	15434	ST-880-1	.GAGE	EA	1
34	23	PEFZZ	4910-01-097-6955	15434	ST-880-2	.ROLL	EA	1
34	24	PEFZZ		15434	ST-880-3	.COLLAR	EA	1
34	25	PEFZZ	5310-01-104-4549	15434	ST-880-6	.NUT THRUST	EA	1
34	26	PEFZZ	4910-01-097-6956	15434	ST-880-7	.MANDREL	EA	1
34	27	PEFFF	4910-00-981-3105	15434	ST-884	CUTTER,INJECTOR SLE	EA	1
34	28	PEFZZ	4910-01-098-5088	15434	ST-884-3	.CUTTER	EA	1
34	29	PEFZZ	4910-01-097-6957	15434	ST-884-1	.HOLDER	EA	1

(1) ILLUSTRATION (a) FIG. NO.	(1) ILLUSTRATION (b) ITEM NO.	(2) SMR CODE	(3) NATIONAL STOCK NUMBER	(4) FSCM	(5) PART NUMBER	(6) DESCRIPTION USABLE ON CODE	(7) U/M	(8) QTY INC IN UNIT
						2604(CONT)		
34	30	PEFZZ		15434	ST-884-5	.PILOT 5-1/8'' BORE	EA	1
34	31	PEFZZ	4910-01-097-6958	15434	ST-884-6	.PILOT 5-1/2'' BORE	EA	1
34	32	PEHHH	5180-01-102-8418	15434	3375189	TOOL KIT,FUEL PUMP AFC FUEL PUMP	EA	1
34	33	PEHZZ	4910-01-097-6943	15434	3375148	.INSTALLING TOOL NO AIR SCREW O RING	EA	1
34	34	PEHZZ	4910-01-097-6940	15434	3375140	.TOOL AFC NO AIR ADJ	EA	1
34	35	PEHZZ	4910-01-097-6941	15434	3375146	.INSTALLING TOOL GLYD RING	EA	4
34	36	PEHZZ	4910-01-097-6942	15434	3375147	.FORMING TOOL GLYD RING	EA	1
34	37	PEHZZ	4910-01-097-6939	15434	3375137	.TOOL AFC ADJUSTING	EA	1
34	38	PEHZZ	4910-01-118-3747	15434	3375204	THROTTLE SHAFT BALL INSTALLATION TOOL	EA	1
34	39	PEHZZ	5120-00-150-7488	15434	3376684	TOOL,COUNTERBORE	EA	1
34	40	PEHZZ	5120-00-150-7489	15434	ST-1065	HOLDER,TOOL	EA	1
34	41	PEHZZ	5120-01-120-5760	15434	ST-1059-17	TOOL BIT,COUNTER	EA	1
34	42	PEHHH	4910-01-098-1914	15434	ST-1242	PARTS KIT BUSHING D	EA	1
34	43	PEHZZ	4910-01-112-7509	15434	ST-1242-3	.TOOL,EMBEDDING BLOC	EA	1
34	44	PEHZZ	4910-01-113-1066	15434	ST-1242-2	.CUP,BUSHING DRIVER	EA	1
34	45	PEHZZ	4910-01-108-9130	15434	ST-1242-1	.MANDREL	EA	1
34	46	PEHZZ	4910-01-118-2878	15434	ST-1242-8	.DRIVER,BEARING AND STRAIGHT	EA	1
34	47	PEHZZ	4910-01-117-4885	15434	ST-1242-7	.RING,KNOCKOUT STRAIGHT	EA	1
34	48	PEHZZ	4910-01-099-1487	15434	ST-1242-5	.KNOCKOUT RING TAPE	EA	1
34	49	PEHZZ	5120-01-119-2743	15434	ST-1242-4	.DRIVER,BEARING AND TAPPERED	EA	1
34	50	PEHZZ	5315-01-110-7835	15434	ST-1242-6	.PIN COTTER	EA	1
34	51	PEHZZ	5110-00-981-3107	15434	ST-490	REAM FIXTURE FUEL PUMP FRONT MAIN BEARING	EA	1
34	52	PEHHH	5120-00-999-1504	15434	ST-709	PULLER,MECHNICAL	EA	1
34	53	PEHZZ	4910-01-097-6930	15434	3375108	.PULLER BUSHING	EA	1
34	54	PEFZZ	4910-01-097-6972	15434	ST-1325	ATTACHMENT DAIL GAGE,FLYWHEEL HOUSING ALIGNMENT	EA	1
34	55	PEFFF	5180-00-944-0374	15434	ST-386	PULLEY ASSY,TOOL	EA	1
34	56	PEFZZ	4910-01-097-6977	15434	ST-386-2	.ARBOR	EA	1
34	57	PEFZZ	4910-01-097-6978	15434	ST-386-3	.NUT	EA	1
34	58	PEFZZ	4910-01-097-6984	15434	ST-386-11	.BALL THRUST BEARING ADAPTER	EA	1

(1) ILLUS-TRATION		(2)	(3)	(4)	(5)	(6)		(7)	(8)
(a) FIG. NO.	(b) ITEM NO.	SMR CODE	NATIONAL STOCK NUMBER	FSCM	PART NUMBER	DESCRIPTION	USABLE ON CODE	U/M	QTY INC IN UNIT
						2604(CONT)			
34	59	PEFZZ	4910-01-097-6979	15434	ST-386-5	.SPACER		EA	1
34	60	PEFZZ	4910-01-097-6985	15434	3375205	.ADAPTER 1/2-13 THREAD		EA	1
34	61	PEFZZ	4910-01-097-6983	15434	ST-386-10	.ADAPTER 2-1/4 IN. X 7/8 IN. DIA		EA	1
34	62	PEFZZ	4910-01-097-6982	15434	ST-386-9	.ADAPTER 2-1/4 IN. X 1 IN. DIA		EA	1
34	63	PEHZZ	4910-01-097-6981	15434	ST-386-8	.ADAPTER 2-1/4 IN. X 1 IN. DIA		EA	1
34	64	PEHZZ	4910-01-097-6980	15434	ST-386-6	.ADAPTER 1-7/8 IN. X 1 IN. DIA		EA	1
34	65	PEHZZ	5120-00-104-1816	15434	3376669	CLAMP,CYLINDER LINE		EA	2
34	66	PEHHH	5120-00-103-4687	15434	ST-669	ADAPTER,TORQUE WREN VALVE ADJUST		EA	1
34	67	PEHZZ	5120-01-091-0689	15434	M1302B18	.SOCKET,SOCKET WRENC 9/16 IN. DEEP DOUBLE HEX		EA	1
34	68	PEHZZ	5120-01-099-6340	15434	ST-699-1	.DRIVER HANDLE ASSEM		EA	1
34	69	PEHZZ	5120-00-288-6514	81348	F-40A	.HANDLE SOCKET 3/8 IN. PLASTIC HANDLE		EA	1
34	70	PEHZZ	5120-01-122-6014	15434	ST-669-13	.SCREWDRIVER BIT 1/2 IN. X 0.062 IN.		EA	1
34	71	PEHZZ	5120-01-091-0690	15434	M-1302B-24	.SOCKET,SOCKET WRENC 3/4 IN. DEEP DOUBLE HEX		EA	1
34	72	PEHZZ	5120-01-865-0226	15434	TM-82	.BIT,SCREWDRIVER 1/4 IN. X 0.032 IN.		EA	1
34	73	PEHZZ	4910-00-150-5797	15434	ST-633	HEAD,GUIDE SPACER		EA	1
34	74	PEHZZ	5210-00-999-1209	15434	ST-560	GAGE,GROOVE WEAR		EA	1
34	75	PEHHH	3460-00-999-1210	15434	ST-691	MANDREL SET,MACHINE		EA	1
34	76	PEHZZ	4910-01-097-6975	15434	ST-691-3	.MANDREL		EA	1
34	77	PEHZZ	4910-01-097-6974	15434	ST-691-2	.BLOCK		EA	1
34	78	PEHZZ	4910-01-097-6973	15434	ST-691-1	.MANDREL		EA	1
34	79	PEHZZ	5120-00-981-3108	15434	ST-1227	DRIVER		EA	1
34	80	PEHZZ	4910-00-999-1506	15434	ST-302	VISE,BALL JOINT		EA	1
34	81	PEHZZ	5120-00-896-8097	15434	ST-419	FRONT SEAL ASSEMBLY		EA	1
34	82	PEHZZ		15434	3376830	CYLINDER LINER RING GAGE		EA	1
34	83	PEHZZ		15434	3376619	DIAL GAGE BORE TOOL		EA	1
34	84	PEHHH	4910-00-185-8508	15434	3375086	ADAPTER POT INJECTOR		EA	1
34	85	PEHZZ	4910-01-085-9211	15434	3375150	CHECKING TOOL BLOWB		EA	1
34	86	PEHZZ	4910-01-097-6948	15434	ST1225	MANDREL,SEAL,THERMO		EA	1
34	87	PEHZZ	5120-01-072-2952	15434	3375159	WRENCH BOX AIR COMPRESSOR		EA	1

(1) ILLUSTRATION		(2) SMR CODE	(3) NATIONAL STOCK NUMBER	(4) FSCM	(5) PART NUMBER	(6) DESCRIPTION		(7) U/M	(8) QTY INC IN UNIT
(a) FIG. NO.	(b) ITEM NO.						USABLE ON CODE		
						2604(CONT)			
34	88	PEHZZ	4910-01-097-6989	15434	3375180	DRIVER WATER PUMP..................................		EA	1
34	89	PEHZZ	4910-01-097-6986	15434	ST-658	MANDREL WATER PUMP BEARING........................		EA	1
34	90	PEHZZ	4910-01-097-6913	15434	ST-1157	GEAR AND SPACER MANDREL,LUBRICATING OIL PUMP.......		EA	1
34	91	PEFZZ	5120-00-104-1795	15434	ST-1179	HOLDING TOOL,INJECT SLEEVE.........................		EA	1
34	92	PEFFF	5120-00-113-5271	15434	ST-1244	EXTRACTOR,SLEEVE...................................		EA	1
34	93	PEFZZ	4910-01-097-6970	15434	3375825	.TIP EXTRACTOR.....................................		EA	1
34	94	PEFZZ	5120-01-120-3682	15434	3375616	.ROD,INJECTOR SLEEVE...............................		EA	1
34	95	PEFZZ	4910-01-097-6969	15434	3375614	.COLLAR FORMING....................................		EA	1
34	96	PEFZZ	5365-01-103-7835	15434	ST-1244-9	.SPACER,RING.......................................		EA	1
34	97	PEFZZ		15434	3375615	.COLLAR..		EA	1
34	98	PEFZZ	5120-01-100-0137	15434	ST-1244-1	.BRIDGE SUPPORT PULL...............................		EA	1
34	99	PEFZZ	3120-01-103-8752	15434	ST-1244-5	.BEARING,WASHER THRU...............................		EA	1
34	100	PEFZZ	5310-01-104-4550	15434	ST-1244-4	.NUT 1-8 THREAD....................................		EA	1
34	101	PEFZZ		15434	ST-1244-3	.NUT 9/16-12 THREAD................................		EA	1
34	102	PEFZZ	5120-01-099-6341	15434	ST-1244-8	.DRIVER..		EA	1
34	103	PEFZZ	4910-01-097-6988	15434	ST-1159	WATER PUMP SEAL WEAR SLEEVE........................		EA	1
34	104	PEFZZ	4910-01-097-6987	15434	ST-1114	FIXTURE BEARING....................................		EA	1
34	105	PEHZZ	5220-01-168-6878	15434	ST-903	GAGE,RING,PLAIN USE WITH /3376619..................		EA	1
34	106	PEHZZ		15434	ST-1177	MAIN BEARING BORE TOOL.............................		EA	1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2 THRU 10
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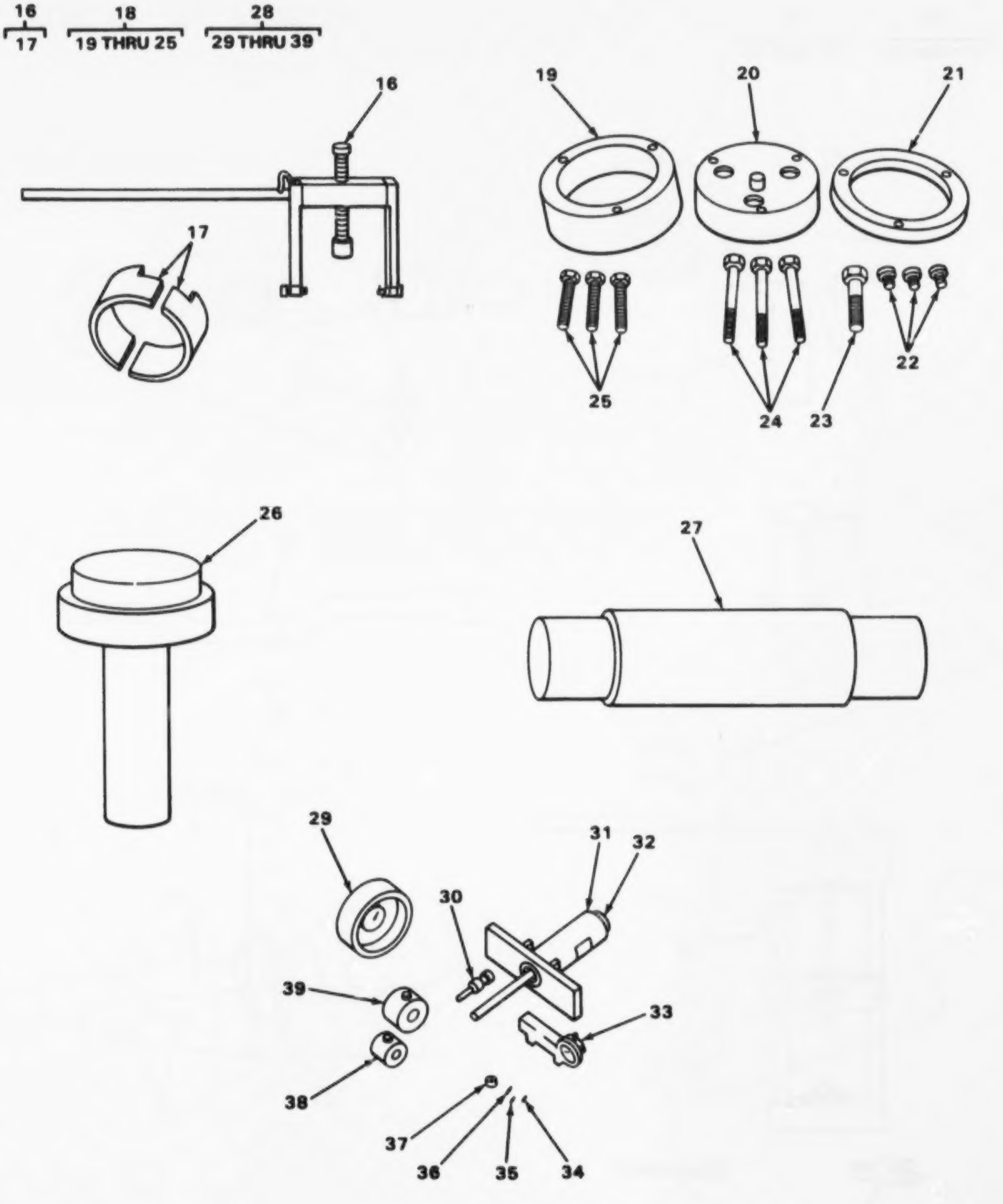
FIGURE 35. GENERAL SUPPORT SUPPLEMENTAL SPECIAL TOOLS (SHEET 1 OF 7)


16
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19 THRU 25
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29 THRU 39
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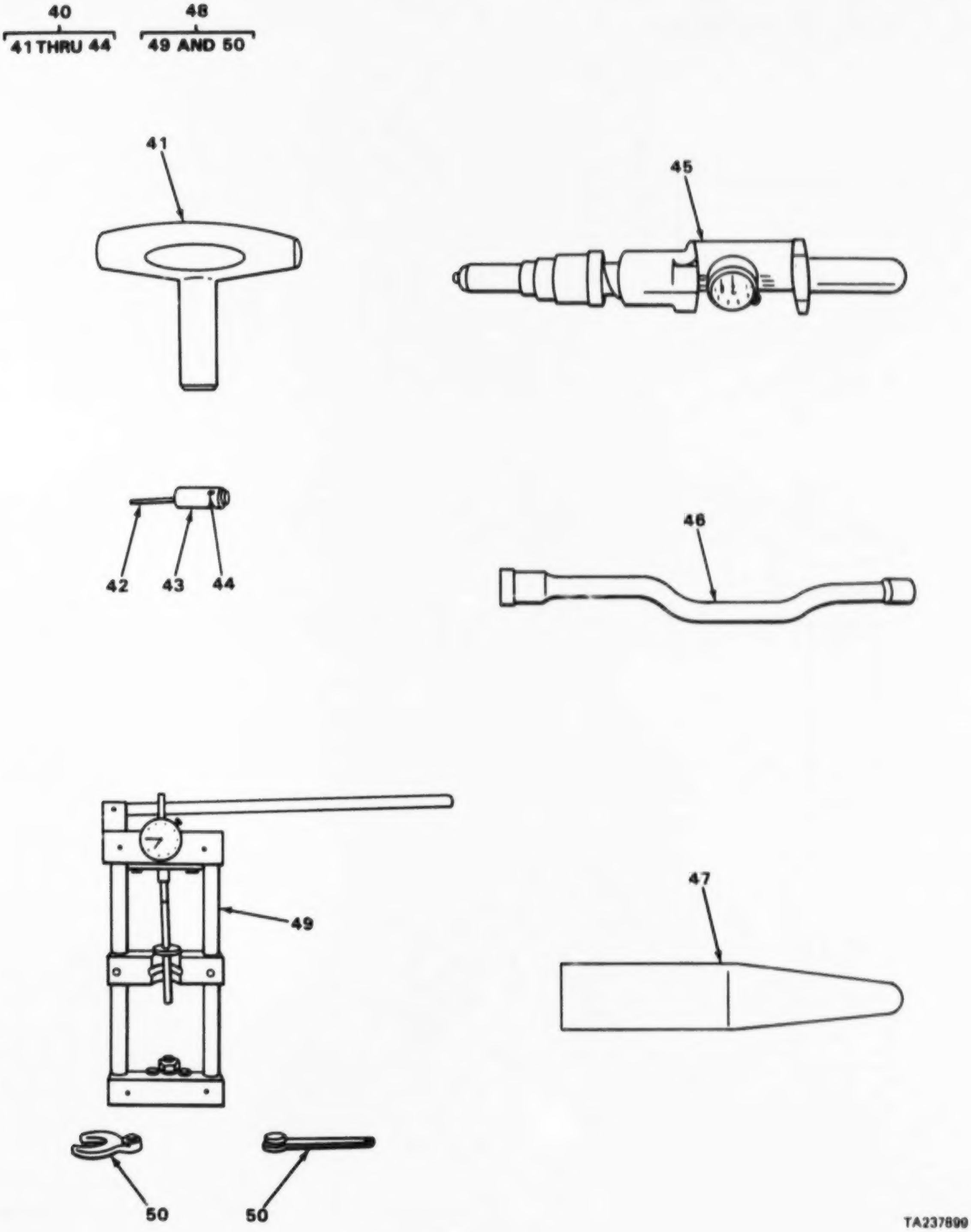
FIGURE 35. GENERAL SUPPORT SUPPLEMENTAL SPECIAL TOOLS (SHEET 2 OF 7.)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41 THRU 44
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49 AND 50
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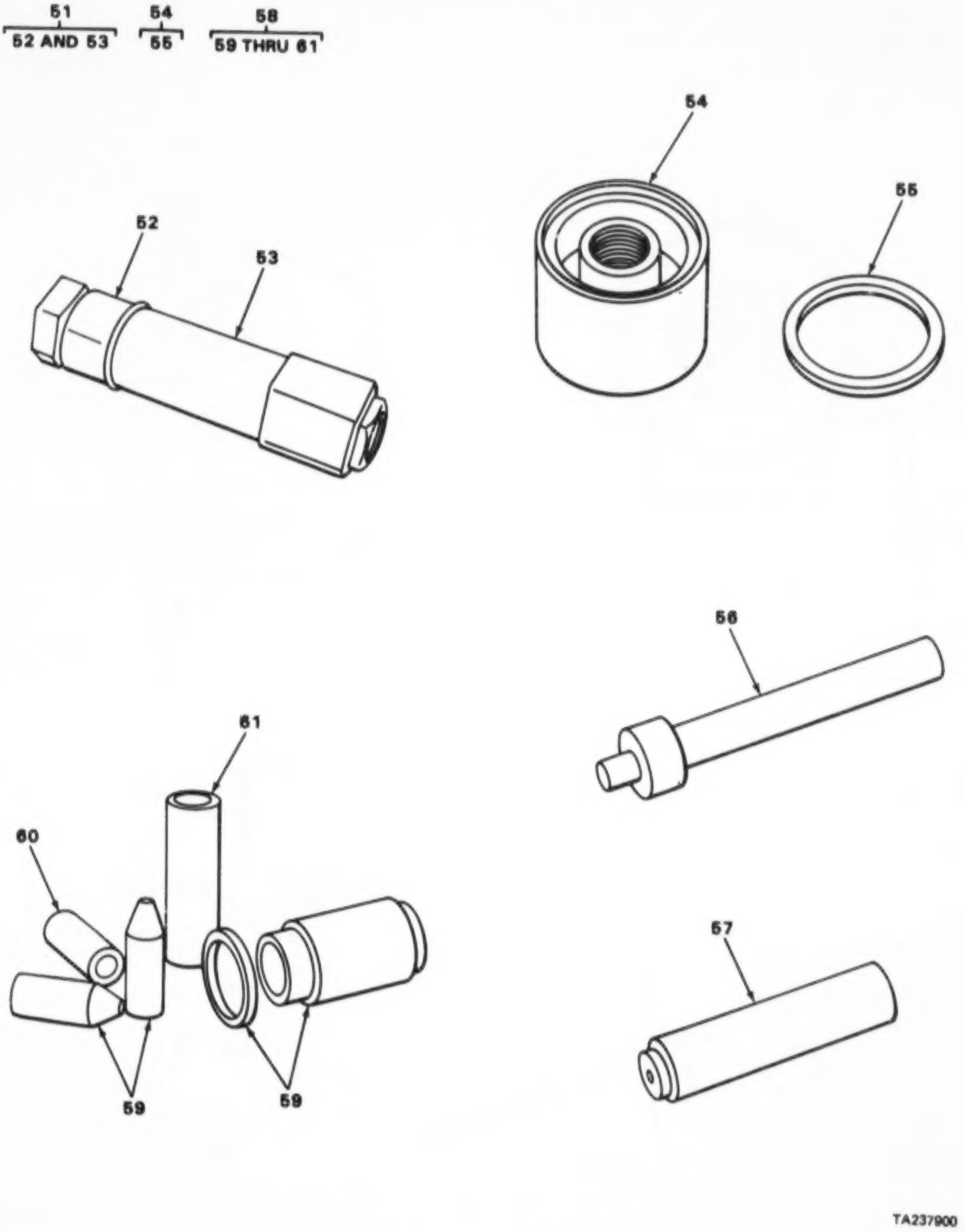
FIGURE 35. GENERAL SUPPORT SUPPLEMENTAL SPECIAL TOOLS (SHEET 3 OF 7.)


51
52 AND 53
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59 THRU 61
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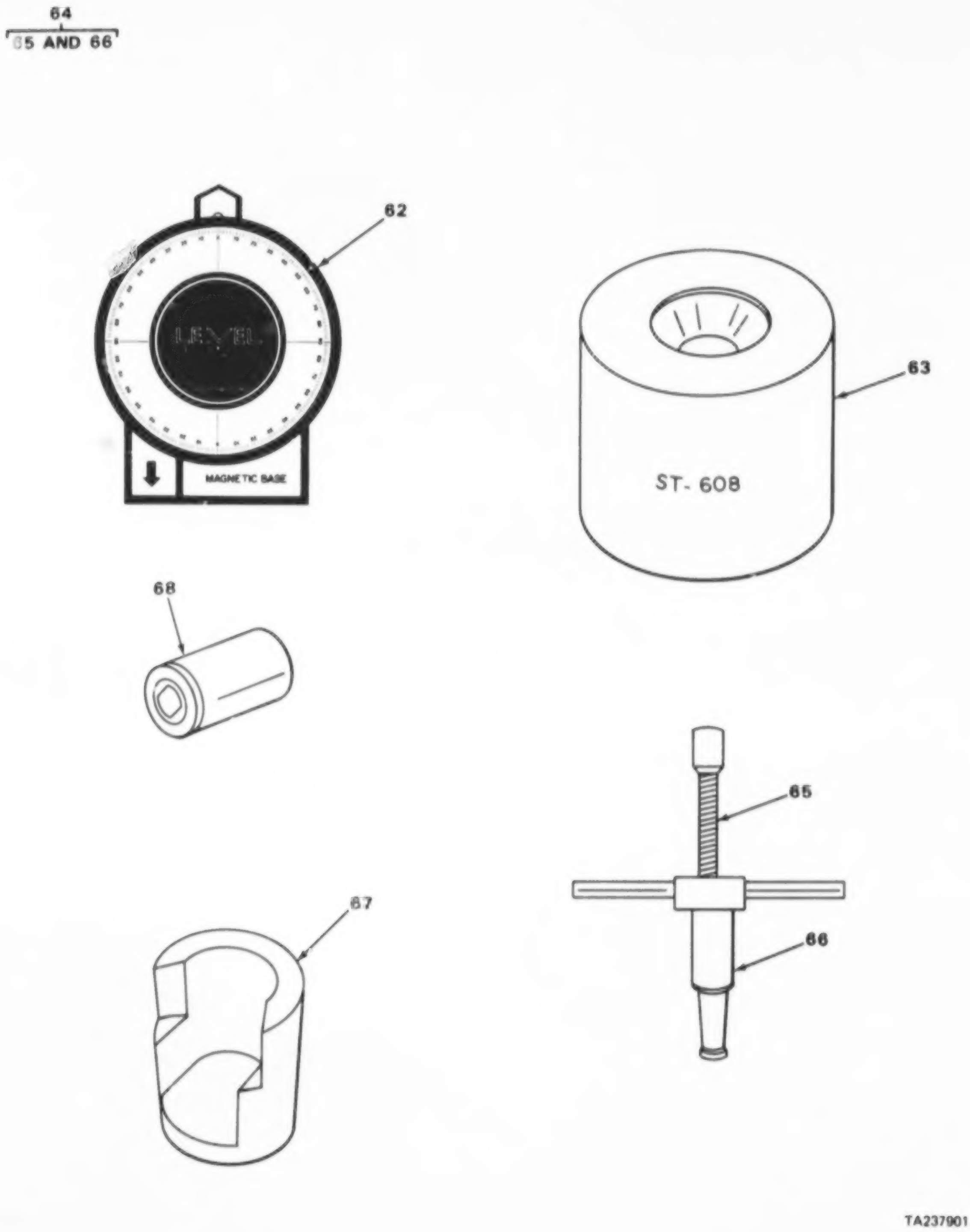
TA237900

FIGURE 35. GENERAL SUPPORT SUPPLEMENTAL SPECIAL TOOLS (SHEET 4 OF 7).


64
65 AND 66
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LEVEL
MAGNETIC BASE
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ST- 608
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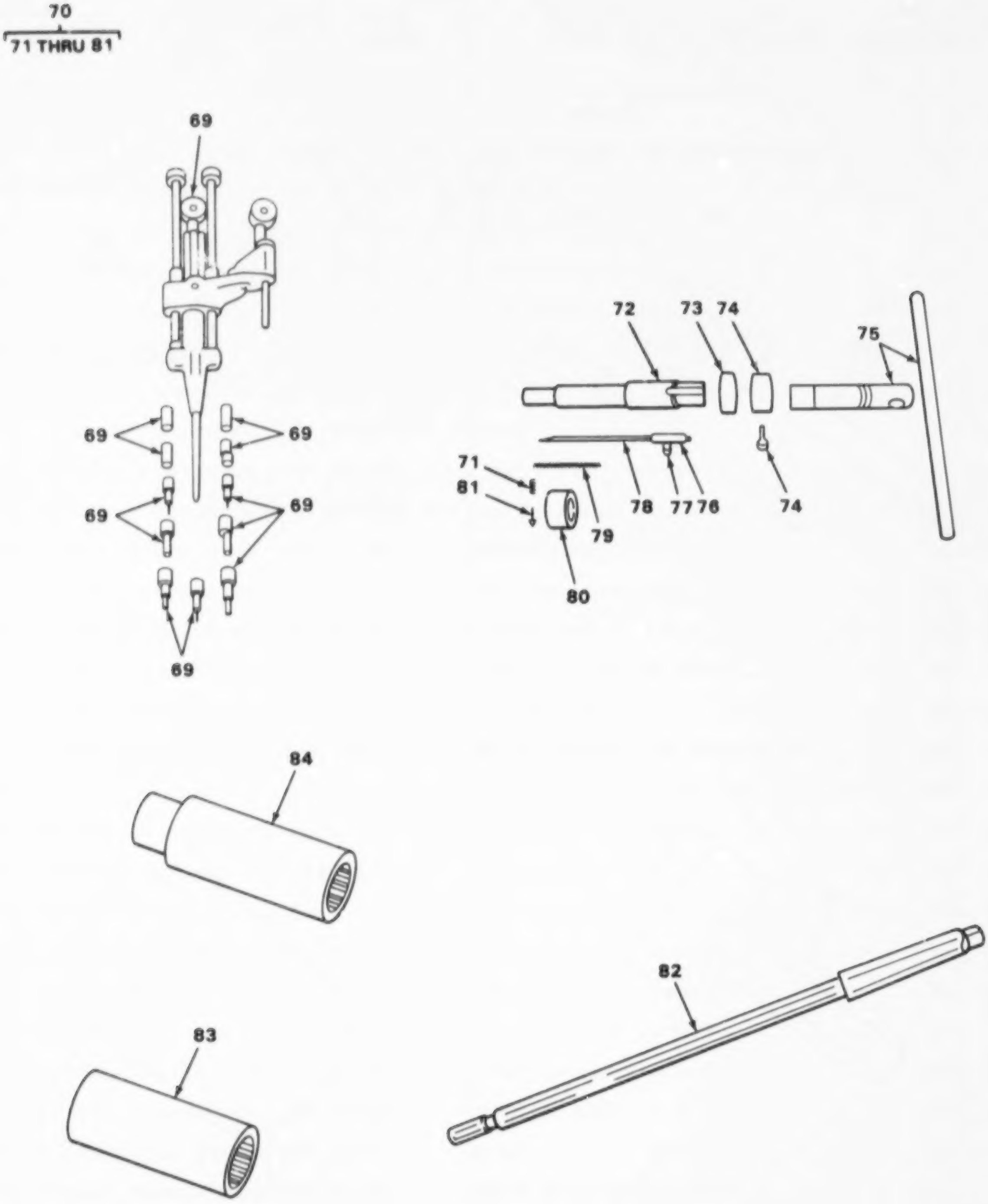
TA237901

FIGURE 35. GENERAL SUPPORT SUPPLEMENTAL SPECIAL TOOLS (SHEET 5 OF 7.)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71 THRU 81
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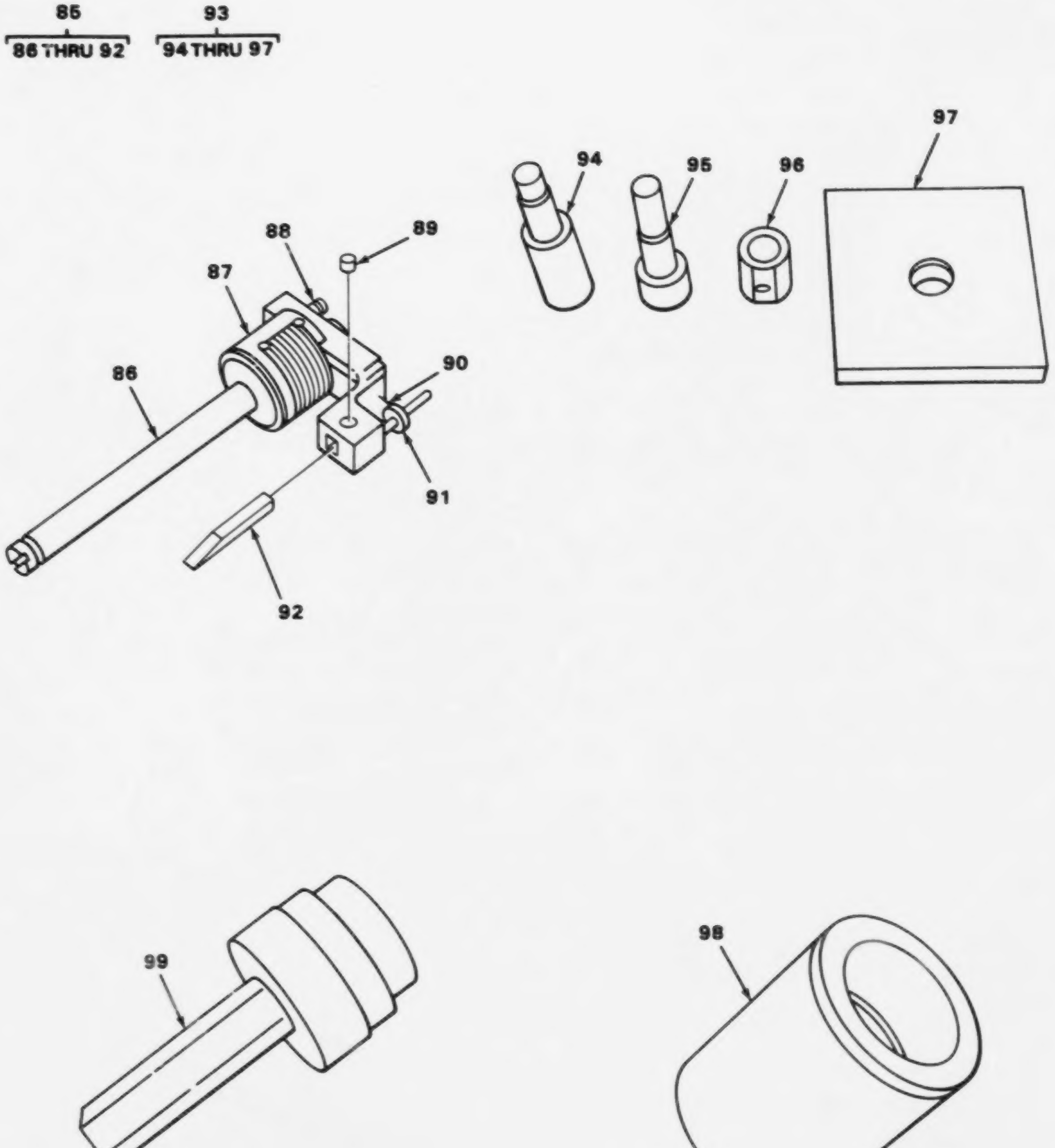
FIGURE 35. GENERAL SUPPORT SUPPLEMENTAL SPECIAL TOOLS(SHEET 6 OF 7.)


85
86 THRU 92
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94 THRU 97
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TA237903

FIGURE 35. GENERAL SUPPORT SUPPLEMENTAL SPECIAL TOOLS (SHEET 7 OF 7.)

(1) ILLUS-TRATION (a) FIG. NO.	(b) ITEM NO.	(2) SMR CODE	(3) NATIONAL STOCK NUMBER	(4) FSCM	(5) PART NUMBER	(6) DESCRIPTION	USABLE ON CODE	(7) U/M	(8) QTY INC IN UNIT
						2604(CONT)			
35	1	PEHHH	4910-01-085-1011	15434	ST-1168	BORING MACHINE,ENGI TOOL LINER COUNTERBORE		EA	1
35	2	PEHZZ	3120-01-085-0762	15434	ST-1168-4	.BEARING,DRIVE		EA	1
35	3	PEHZZ	5305-01-084-4596	15434	ST-1168-6	.SETSCREW DRIVE		EA	1
35	4	PEHZZ	4910-01-085-0763	15434	ST-1168-3	.SHAFT,CHAIN DRIVE		EA	1
35	5	PEHZZ	3020-01-085-0761	15434	ST-1168-5	.DRIVE,SPROCKET		EA	1
35	6	PEHZZ	3020-01-084-7007	15434	ST-1168-7	.CHAIN,ROLLER		EA	1
35	7	PEHZZ	3020-01-086-8269	15434	ST-1168-10	.SPROCKET,DRIVEN		EA	1
35	8	PEHZZ	4910-01-098-1912	15434	ST-1168-19	.TOOL BIT		EA	1
35	9	PEHZZ	4910-01-086-8268	15434	ST-1168-8	.SNAP RING,SHAFT DRIVE SHAFT		EA	1
35	10	PEHZZ	4910-01-088-7904	15434	ST-1168-9	.SNAP RING,BEARING DRIVE BEARING		EA	1
35	11	PEHZZ	4910-01-085-0764	15434	ST-1255	COUNTERBORE,TOOL LINER		EA	1
35	12	PEHHH	4910-01-085-0765	15434	ST-1287	BORING TOOL,CYLINDE LOWER LINER		EA	1
35	13	PEHZZ	5133-01-084-6008	15434	ST-1287-10	.TOOL BIT		EA	1
35	14	PEHHH	4910-01-085-0766	15434	ST-1318	CHAMBER TOOL,LOWER BORE SLEEVE		EA	1
35	15	PEHZZ	5133-01-084-6009	15434	ST-1318-23	.BIT,LOWER LINER		EA	1
35	16	PEHHH	5120-01-120-5759	15434	3375834	GEAR PULLER ASSEMBL CRANK BRIDGE ASSEMBLY		EA	1
35	17	PEHZZ	4910-01-097-6909	15434	3375839	.PULLER JAW CRANKSHAFT GEAR		EA	1
35	18	PEHHH	4910-01-106-0492	15434	ST-1259	PULLER-INSTALLER OIL SEAL		EA	1
35	19	PEHZZ	4910-01-097-6919	15434	ST-1259-4	.TOOL,SPACER RING 1-7/16 IN		EA	1
35	20	PEHZZ	4910-01-097-6916	15434	ST-1259-1	.PLATE TOP		EA	1
35	21	PEHZZ	4910-01-097-6917	15434	ST-1259-2	.TOOL SPACER RING 3/16 IN		EA	1
35	22	PEHZZ	4910-01-097-6918	15434	ST-1259-3	.SCREW ALLEN HEAD 1/4-20 X 1/2 IN		EA	3
35	23	PEHZZ	4910-01-098-1913	15434	ST-1259-7	.SCREW MAIN PULLER 1/2-13 X 2 IN		EA	1
35	24	PEHZZ	4910-01-097-6920	15434	ST-1259-5	.SCREW ALLEN HEAD 1/4-20 X 1-3/4 IN		EA	3
35	25	PEHZZ	4910-01-097-6921	15434	ST-1259-6	.SCREW SEAL PULLER		EA	3
35	26	PEHZZ	4910-01-105-9165	15434	3375153	DRIVER		EA	1
35	27	PEHZZ	4910-01-097-6914	15434	ST-1158	BUSHING MANDREL LUBRICATING PUMP		EA	1
35	28	PEHHH	4910-01-085-7824	15434	3375206	BORING TOOL,BUSHING LUBRICATION PUMP BODY COVER		EA	1
35	29	PEHZZ	4910-01-085-0751	15434	3375223	.GUIDE,BUSHING BORIN		EA	1

(1) ILLUS-TRATION		(2)	(3)	(4)	(5)	(6)		(7)	(8)
(a) FIG. NO.	(b) ITEM NO.	SMR CODE	NATIONAL STOCK NUMBER	FSCM	PART NUMBER	DESCRIPTION	USABLE ON CODE	U/M	QTY INC IN UNIT
						2604(CONT)			
35	30	PEHZZ	4910-01-084-6979	15434	3375229	.DRIVE ADAPTER,BORTO		EA	1
35	31	PEHZZ	4930-01-085-3728	15434	3375220	.HOUSING,BORING TOOL		EA	1
35	32	PEHZZ	5355-01-097-7072	15434	3375228	.KNOB PLASTIC		EA	1
35	33	PEHZZ	5355-01-097-0157	15434	3375227	.DIAL,INDICATOR		EA	1
35	34	PEHZZ	4910-01-085-7269	15434	3375226	.BIT,BORING TOOL,BUS		EA	1
35	35	PEHZZ	4910-01-084-7222	15434	3375225	.CUTTER BIT,BORING M		EA	1
35	36	PEHZZ	4910-01-084-7221	15434	3375207	.CUTTER BIT,BORING M		EA	1
35	37	PEHZZ	5355-01-084-5323	15434	3375224	.KNOB CUTTER ADJUSTING		EA	1
35	38	PEHZZ	4910-01-084-6977	15434	3375221	.GUIDE,BUSHING		EA	1
35	39	PEHZZ	4910-01-084-6978	15434	3375222	.GUIDE,BUSHING		EA	1
35	40	PEHHH	5120-01-120-3681	15434	3376177	TORQUE WRENCH,INJEC ORIFICE		EA	1
35	41	PEHZZ	5120-01-072-2955	15434	ST-1090	.TORQUE WRENCH INCH POUND		EA	1
35	42	PEHZZ	4910-01-097-6924	15434	ST-1090-4	.SET SCREW		EA	1
35	43	PEHZZ		15434	3376197	.SCREWDRIVER		EA	1
35	44	PEHZZ	4910-01-097-6923	15434	ST-1090-3	.WRENCH ALLEN 5/64 IN.		EA	1
35	45	PEHZZ	4910-01-097-6922	15434	ST-981	CHECKING TOOL INJECTOR PROTRUSTION		EA	1
35	46	PEHZZ	4610-01-097-6925	15434	ST-1145	TORQUING TOOL INJECTOR		EA	1
35	47	PEHZZ	5120-00-896-8089	15434	ST-442	ORING ASSEMBLY TOOL 'O' RING		EA	1
35	48	PEHHH	4910-01-097-6926	15434	3375160	FIXTURE TOP STOP INJECTOR SETTING		EA	1
35	49	PEHZZ	4910-01-097-6927	15434	3375165	.TOOL,ADJUSTING		EA	1
35	50	PEHZZ	4910-01-097-6928	15434	3375166	.WRENCH CROWSFOOT 1-3/8 IN.,LOCKNUT WRENCH		EA	1
35	51	PEHHH	4910-01-097-6932	15434	ST-1326	PULLER TACHO DRIVER		EA	1
35	52	PEHZZ	4910-01-097-6934	15434	ST-1326-2	.COLLAR		EA	1
35	53	PEHZZ	4910-01-097-6933	15434	ST-1326-1	.COLLET		EA	1
35	54	PEHHH	4910-01-097-6935	15434	3375014	ADAPTER PLATE FUEL FILTER		EA	1
35	55	PEHZZ	5330-01-107-1841	15434	3375015	.GASKET		EA	1
35	56	PEHZZ	4910-01-097-6944	15434	3375230	INSTALLING TOOL CAST GOVERNOR WEIGHT CARRIER		EA	1
35	57	PEHZZ	4910-01-097-6945	15434	3375271	MANDREL TACHOMETER DRIVE CUP PLUG		EA	1
35	58	PEHHH	5120-01-074-0019	15434	3375175	TOOL KIT,MAIN SHAFT ASSEMBLY		EA	1

(1) ILLUSTRATION (a) FIG. NO.	(1) ILLUSTRATION (b) ITEM NO.	(2) SMR CODE	(3) NATIONAL STOCK NUMBER	(4) FSCM	(5) PART NUMBER	(6) DESCRIPTION	USABLE ON CODE	(7) U/M	(8) QTY INC IN UNIT
						2604(CONT)			
35	59	PEHZZ	4910-01-097-6936	15434	3375172	.INSTALLING TOOL MAIN SHAFT AND BEARING		EA	1
35	60	PEHZZ	4910-01-097-6937	15434	3375173	.DRIVER MAIN SHAFT SEAL		EA	1
35	61	PEHZZ	4910-01-097-6938	15434	3375174	.DRIVER FRONT COVER		EA	1
35	62	PEHZZ	4910-01-074-0020	15434	3375855	TEMPLATE,FUEL PUMP TRAVEL TEMPLATE		EA	1
35	63	PEHZZ	4910-01-086-9766	15434	ST-608	TURBO SUPPORT BLOCK		EA	1
35	64	PEHHH	5120-00-065-1031	15434	ST-544	PULLER ASSEMBLY		EA	1
35	65	PEHZZ	5305-01-100-0136	15434	ST-544-2	.SCREW,VALVE PULLER		EA	1
35	66	PEHZZ	5305-01-100-0135	15434	ST-544-1	.PULLER,VALVE SEAT		EA	1
35	67	PEHZZ	5120-00-923-0856	15434	ST-351	HOLDER		EA	1
35	68	PEHZZ	5120-00-116-7625	15434	ST-1095	SOCKET,SOCKET WRENC		EA	1
35	69	PEFZZ	4910-00-712-0537	15434	ST-593	INDICATOR,ENGINE TI INJECTOR TIMING		EA	1
35	70	PEFFF	5120-00-178-0948	15434	ST-1100	TOOL,GROOVING		EA	1
35	71	PEFZZ	4910-01-097-6966	15434	ST-1100-12	.SPRING TOOL		EA	1
35	72	PEFZZ	4910-01-097-6964	15434	ST-1100-10	.BODY 5-1/2 IN. BORE		EA	1
35	73	PEFZZ	4910-01-097-6961	15434	ST-1100-7	.NUT,ADJUSTING		EA	1
35	74	PEFZZ		15434	ST-1100-5	.NUT		EA	1
35	75	PEFZZ		15434	ST-1100-1	.BODY		EA	1
35	76	PEFZZ	4910-01-097-6960	15434	ST-1100-6	.CAP SCREW 1/4-28 X 3/16 IN		EA	1
35	77	PEFZZ	4910-01-097-6962	15434	ST-1100-8	.SLEEVE ROD		EA	1
35	78	PEFZZ	4910-01-097-6965	15434	ST-1100-11	.ROD TOOL ADJUSTING		EA	1
35	79	PEFZZ	4910-01-097-6963	15434	ST-1100-9	.SPRING ROD		EA	1
35	80	PEFZZ	4910-01-097-6968	15434	ST-1100-14	.CAP,TOOL SETTING		EA	1
35	81	PEFZZ	4910-01-097-6967	15434	ST-1100-13	.CUTTING TOOL		EA	1
35	82	PEFZZ	5110-00-980-7347	15434	ST-646	REAMER		EA	1
35	83	PEFZZ	5120-01-093-3382	55719	B1465A	SOCKET,SOCKET WRENC		EA	1
35	84	PEFZZ	5120-01-092-3275	55719	STMD-8	SOCKET,SOCKET WRENC		EA	1
35	85	PEFFF	4910-00-999-1499	15434	ST-913	TOOL,CYLINDER HEAD		EA	1
35	86	PEFZZ		15434	ST-913-1	.LOCKSCREW		EA	1
35	87	PEFZZ		15434	ST-913-7	.BEARING		EA	1

(1) ILLUSTRATION		(2)	(3)	(4)	(5)	(6)	(7)	(8)
(a) FIG. NO.	(b) ITEM NO.	SMR CODE	NATIONAL STOCK NUMBER	FSCM	PART NUMBER	DESCRIPTION USABLE ON CODE	U/M	QTY INC IN UNIT
						2604(CONT)		
35	88	PEFZZ		15434	ST-913-11	.PLUG,LOCKING	EA	1
35	89	PEFZZ		15434	ST-913-18	.INSERT FIBER	EA	4
35	90	PEFZZ		15434	ST-913-23	.SCREW ASSEMBLY ADJUSTING	EA	1
35	91	PEFZZ		15434	ST-913-14	.HOLDER,TOOL	EA	1
35	92	PEFZZ	4910-01-097-6959	15434	ST-913-17	.TOOL BIT	EA	1
35	93	PEFFF	5180-00-916-1813	15434	ST-249	TOOL KIT,DIESEL INJ BLOCK AND MANDREL LEVER	EA	1
35	94	PEFZZ	5120-01-106-9173	15434	ST-249-1	.MANDREL	EA	1
35	95	PEFZZ	5120-01-097-3204	15434	ST-249-2	.MANDREL	EA	1
35	96	PEFZZ	5120-01-106-9174	15434	ST-249-3	.SLEEVE,MANDREL	EA	1
35	97	PEFZZ		15434	ST-249-4	.BLOCK	EA	1
35	98	PEFZZ	5120-00-159-8916	15434	ST-659	MANDREL,WATER PUMP SEAL	EA	1
35	99	PEFZZ	4910-01-097-6976	15434	ST-1218	MANDREL O RING	EA	1

NATIONAL STOCK NUMBER AND PART NUMBER INDEX

NATIONAL STOCK NUMBER	FIGURE NO.	ITEM NO.
5330-00-003-1771	14	16
5330-00-003-1771	14	32
5330-00-005-0407	31	19
3120-00-005-0601	4	7
3120-00-005-0602	4	15
5330-00-005-0857	16	1
3120-00-005-5882	4	12
3120-00-005-5883	4	5
3120-00-005-5884	4	17
5310-00-005-6052	20	65
2815-00-005-7431	8	10
5330-00-006-2494	22	17
3120-00-007-2901	4	6
5360-00-009-9270	3	7
5310-00-010-3322	12	25
4730-00-010-3867	11	28
4730-00-010-3867	12	3
4730-00-010-3867	16	3
4730-00-010-3867	31	14
4730-00-011-3175	24	16
2815-00-011-7786	2	1
5330-00-011-7939	31	13
5315-00-014-1195	2	19
5315-00-014-1215	20	27
5315-00-014-1244	22	5
5315-00-014-1284	5	19
5305-00-018-6494	20	2
4730-00-018-9566	2	32
4730-00-018-9566	3	22
4730-00-018-9566	5	20
4730-00-018-9566	11	24
4730-00-018-9566	17	24
4730-00-018-9566	31	16
5330-00-026-2931	17	16
5330-00-026-2933	23	22
5330-00-033-9396	13	42
5310-00-041-1795	20	78
4730-00-042-8988	2	28
4730-00-042-8988	16	19
4730-00-042-8988	20	57
5310-00-043-1787	13	11
5120-00-055-4013	34	10
5330-00-058-1767	2	5
5305-00-058-6604	31	22
5305-00-062-4378	3	13
5305-00-062-4378	3	15
5330-00-064-4399	2	3
5120-00-065-1031	35	64
5305-00-069-5584	12	26
5330-00-080-0483	26	20
5310-00-080-6004	12	18
5310-00-080-6004	13	25
5310-00-080-6004	14	14
5310-00-080-6004	16	16
5310-00-081-8500	4	2
5310-00-081-8500	5	15
5330-00-081-9289	20	71
5310-00-081-9292	17	18
5330-00-081-9299	24	7
5360-00-082-0124	25	41

NATIONAL STOCK NUMBER	FIGURE NO.	ITEM NO.
5315-00-082-0448	25	24
5355-00-082-1189	24	18
5310-00-082-1888	24	6
2910-00-084-7787	24	11
4820-00-084-7813	24	14
2815-00-085-7434	3	31
2815-00-085-7442	3	26
5340-00-087-7486	14	44
5305-00-091-4009	5	16
5120-00-103-4687	32	49
5120-00-103-4687	34	66
5340-00-103-9988	23	9
5120-00-104-1795	32	15
5120-00-104-1795	34	91
5120-00-104-1816	34	65
2910-00-112-7950	25	9
5120-00-113-5271	32	17
5120-00-113-5271	34	92
5120-00-116-7625	35	68
4820-00-130-4820	22	11
5360-00-132-0245	19	13
5330-00-132-0247	19	22
5330-00-132-0248	11	23
2815-00-132-0273	6	2
5330-00-132-0274	20	64
5330-00-132-0274	24	15
5330-00-132-0276	19	18
2910-00-132-0769	25	43
5340-00-132-3203	15	5
5310-00-134-4168	5	6
5310-00-134-4169	14	10
5310-00-134-4171	5	10
5365-00-135-2166	23	33
5305-00-138-9848	24	8
5310-00-141-1795	20	5
5310-00-141-1795	25	47
5310-00-141-1795	26	11
5330-00-143-8369	29	1
5330-00-143-8376	13	34
5330-00-143-8485	3	19
3110-00-144-8519	31	8
3110-00-144-8828	31	30
4910-00-150-5797	32	30
4910-00-150-5797	34	73
4910-00-150-5801	34	2
4910-00-150-5805	34	7
4910-00-150-5810	34	5
4910-00-150-5858	32	14
4910-00-150-5858	34	9
5120-00-150-7488	34	39
5120-00-150-7489	34	40
5120-00-150-7492	32	71
5120-00-150-7492	34	4
5330-00-159-1464	28	11
5310-00-159-6209	14	12
5310-00-159-6209	14	34
5310-00-159-6209	20	42
5310-00-159-6209	21	14
5310-00-159-6209	22	2
5310-00-159-6209	23	13

NATIONAL STOCK NUMBER AND PART NUMBER INDEX

NATIONAL STOCK NUMBER	FIGURE NO.	ITEM NO.
5120-00-159-8916	33	24
5120-00-159-8916	35	98
3020-00-160-9092	17	12
5310-00-164-1904	23	19
2910-00-174-5822	26	18
5305-00-177-5552	12	13
5120-00-178-0948	33	3
5120-00-178-0948	35	70
4910-00-185-8508	34	84
5330-00-194-8385	23	6
2810-00-195-5894	8	20
2815-00-195-5897	8	15
4730-00-196-0936	29	6
5310-00-197-5304	2	29
5365-00-197-9327	11	43
5365-00-197-9327	12	2
4730-00-202-8470	13	40
5305-00-206-4527	29	19
5305-00-207-2715	26	10
5310-00-209-0965	13	18
5310-00-209-0965	16	5
5310-00-209-0965	25	14
5310-00-209-0965	25	16
4730-00-221-2139	29	9
5306-00-225-8499	14	17
5305-00-225-9081	13	26
2815-00-230-0070	8	31
5305-00-230-1939	23	12
5310-00-232-8194	14	42
5330-00-237-6266	23	20
5315-00-238-0882	16	12
2910-00-238-5435	19	4
5330-00-246-0309	12	22
5365-00-256-2846	20	66
5310-00-261-7340	9	2
5310-00-261-7340	12	16
5310-00-261-7340	12	28
5310-00-261-7340	28	2
5310-00-261-7340	29	18
5310-00-261-7340	31	34
5310-00-262-2986	24	2
5305-00-269-3211	12	19
5305-00-269-3211	14	33
5305-00-269-3213	11	35
5305-00-269-3213	13	20
5305-00-269-3213	14	25
5305-00-269-3213	16	18
5305-00-269-3214	14	2
5305-00-269-3214	14	11
2950-00-275-8276	23	17
4820-00-276-9041	11	27
4730-00-278-3848	11	4
4730-00-278-9200	21	2
5315-00-281-7610	2	16
5365-00-282-5030	6	12
5365-00-282-5030	6	15
5120-00-288-6514	32	50
4730-00-289-1935	29	21
5120-00-298-6514	34	69
2815-00-300-0882	3	10
2910-00-338-6839	12	5
5305-00-339-1415	9	24
5330-00-351-6428	12	8
2930-00-353-9164	20	48
5310-00-356-1447	2	14
5365-00-361-2953	16	14
5365-00-361-2953	16	14
4720-00-361-2989	12	11
4730-00-369-7824	25	49
5340-00-400-3449	23	25
2910-00-400-5178	20	26
2930-00-401-9531	17	27
5330-00-403-9896	20	20
5305-00-404-1390	14	13
4730-00-404-2906	29	5
4730-00-404-2908	2	33
5330-00-404-2920	5	4
5365-00-404-2934	3	5
2815-00-404-2940	8	9
2815-00-404-2940	8	14
2815-00-404-2940	8	19
2815-00-404-2940	8	24
2815-00-404-2940	8	29
5340-00-404-2944	7	12
2910-00-404-3054	19	16
2815-00-406-6737	23	3
5330-00-406-7789	23	31
2815-00-406-8936	13	3
5310-00-407-9566	11	33
5310-00-407-9566	25	11
5310-00-407-9566	28	13
3130-00-408-9041	2	31
2910-00-410-2268	20	44
5310-00-410-6756	20	6
5305-00-411-9340	23	10
5340-00-417-5800	12	17
5306-00-418-2276	27	13
3020-00-424-9995	7	11
5310-00-426-3390	3	14
5310-00-426-3990	3	12
5305-00-426-4142	13	33
5305-00-426-4142	20	76
5305-00-426-4142	25	50
5305-00-426-4142	26	1
5365-00-428-6201	4	16
2950-00-432-1559	23	27
5360-00-436-7340	20	45
4730-00-444-1710	3	4
3040-00-449-7397	20	1
3040-00-449-7397	20	46
2910-00-451-8063	25	30
5330-00-452-1748	7	6
2910-00-455-1406	24	13
5360-00-461-5738	25	54
5365-00-462-4504	25	53
5310-00-469-3998	5	18
5310-00-470-6154	17	10
5330-00-471-0370	25	37
5315-00-475-2574	13	12
5305-00-477-0395	15	7

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NATIONAL STOCK NUMBER	FIGURE NO.	ITEM NO.
4730-00-477-4160	14	8
2990-00-477-6159	23	32
5305-00-477-6769	3	17
5305-00-477-6769	20	3
2815-00-480-4347	6	13
2815-00-480-4347	6	16
5310-00-484-1718	20	77
5310-00-484-1718	22	10
5310-00-484-1718	24	3
5310-00-484-1718	26	2
2815-00-484-8359	2	24
2815-00-484-8360	2	21
5306-00-485-0790	22	9
5340-00-485-0945	9	21
5365-00-485-9250	2	6
5310-00-486-2507	17	20
5365-00-487-1927	2	6
5365-00-488-0799	2	6
3120-00-493-3913	20	41
5305-00-493-3959	20	43
2815-00-505-5119	9	15
5330-00-506-4866	25	22
5330-00-506-4874	29	4
5305-00-506-5722	25	44
5365-00-507-3224	20	33
5365-00-507-3225	20	33
5365-00-507-3254	16	14
5310-00-507-3259	25	42
5365-00-507-3260	25	53
5365-00-507-3261	25	53
5365-00-507-3271	20	59
5305-00-509-8106	24	4
3110-00-516-5289	25	18
5310-00-521-8595	13	39
5310-00-521-8595	14	40
5310-00-521-8595	21	8
3020-00-528-5053	5	13
5315-00-532-9388	2	20
5330-00-537-2382	11	3
4720-00-541-4243	BULK	1
5365-00-543-3744	20	33
5306-00-546-6698	9	1
5305-00-550-4710	20	40
4730-00-555-8263	14	5
4730-00-555-8263	23	14
5330-00-562-1176	25	45
5310-00-562-6552	26	12
5310-00-562-6557	13	19
5310-00-562-6557	16	6
5310-00-562-6560	21	13
5310-00-562-6560	23	8
3120-00-566-0480	13	28
5330-00-567-3463	22	12
2910-00-567-4354	22	14
5310-00-584-5272	1	2
5310-00-584-5272	5	7
5310-00-584-5272	11	11
3120-00-589-3537	8	7
3120-00-589-3537	8	17
3120-00-589-3537	8	22
3120-00-589-3537	8	27
2815-00-590-7378	10	1
5360-00-597-4570	20	61
4730-00-604-7953	14	28
3120-00-627-6697	13	10
5330-00-632-6182	23	24
2815-00-632-6239	3	6
5310-00-637-9541	12	20
5310-00-637-9541	13	32
5310-00-637-9541	14	3
5310-00-637-9541	16	17
5310-00-637-9541	21	7
2910-00-646-9727	27	8
5330-00-659-3178	15	1
3120-00-659-7808	9	9
5360-00-664-5343	11	42
5310-00-680-6874	23	7
3120-00-682-7706	23	26
5310-00-684-3463	14	26
5365-00-695-1247	12	6
4810-00-695-3284	24	1
3020-00-702-3882	22	13
2815-00-705-2856	13	6
4910-00-712-0537	33	1
4910-00-712-0537	35	69
5365-00-716-6580	16	23
5365-00-716-6580	22	8
3120-00-719-5719	22	16
5305-00-721-3698	22	1
5310-00-727-8353	25	25
5310-00-732-0560	8	3
9905-00-733-7622	20	58
5310-00-763-8920	31	23
3120-00-764-7090	20	37
2815-00-767-4012	15	10
2990-00-772-1778	20	38
2815-00-772-9434	16	20
5315-00-777-3544	9	6
5315-00-777-3544	9	12
5305-00-782-9495	11	10
2910-00-790-8736	20	62
3120-00-791-1440	9	16
2815-00-791-1453	11	41
3120-00-792-9834	17	25
5305-00-795-9336	4	1
5305-00-795-9336	5	9
4730-00-801-8186	2	17
2910-00-803-2631	25	40
5306-00-804-2468	2	23
5305-00-804-6318	1	6
5305-00-804-6318	20	51
5305-00-804-6318	23	2
5305-00-804-6454	12	4
5340-00-809-1490	27	9
5330-00-809-2667	26	7
5330-00-809-3276	26	5
3120-00-810-6032	20	30
2815-00-815-0355	31	7
2815-00-815-0355	31	27
5365-00-815-1137	19	20

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2815-00-828-7013	13	4
2815-00-829-5227	15	13
2990-00-829-5600	24	17
2910-00-829-5604	20	36
2910-00-829-5617	26	9
5340-00-839-0653	12	12
5305-00-851-5992	21	4
2815-00-851-7637	8	5
2910-00-858-3522	25	46
5330-00-861-8592	8	38
5330-00-864-5422	28	16
5120-00-865-0226	32	52
5120-00-865-0933	33	25
5315-00-866-5015	3	28
2910-00-869-3428	22	3
5310-00-873-1153	21	10
3120-00-877-2213	16	9
5310-00-887-8325	15	6
5120-00-896-8087	34	3
5120-00-896-8089	35	47
5120-00-896-8097	32	59
5120-00-896-8097	34	81
5340-00-898-1497	25	52
4730-00-900-3296	21	23
3120-00-904-9595	25	28
5315-00-907-0711	20	35
2815-00-907-8964	25	39
4730-00-908-3195	30	4
4730-00-909-8627	28	8
5180-00-916-1813	33	26
5180-00-916-1813	35	93
2815-00-920-2073	15	4
2815-00-920-8356	15	2
5307-00-922-2626	15	12
3441-00-922-6699	32	3
3441-00-922-6699	34	21
5120-00-923-0856	35	67
5330-00-924-7757	19	19
4730-00-924-7886	2	13
4730-00-927-7272	13	17
2910-00-928-3505	3	18
2930-00-928-3595	29	22
5110-00-932-2089	32	2
5110-00-932-2089	34	20
2815-00-933-3009	3	8
2910-00-933-3012	22	15
3120-00-936-8209	4	13
5180-00-944-0374	32	35
5180-00-944-0374	34	55
5305-00-947-3437	8	2
2910-00-951-3536	26	6
5330-00-951-3538	24	12
5330-00-961-9470	20	60
5310-00-962-5610	3	2
2815-00-962-5623	3	21
5305-00-964-0565	13	24
5365-00-965-0870	26	8
5310-00-971-7989	20	8
5310-00-971-7989	20	49
5110-00-980-7347	33	2
5110-00-980-7347	35	82
4910-00-981-3105	34	27
5910-00-981-3105	32	9
5110-00-981-3107	34	51
5120-00-981-3108	32	16
5120-00-981-3108	34	79
2815-00-994-4427	6	7
2815-00-994-4434	3	9
5120-00-999-1209	32	61
5210-00-999-1209	34	74
3460-00-999-1210	32	31
3460-00-999-1210	34	75
4910-00-999-1499	33	15
4910-00-999-1499	35	85
5120-00-999-1504	32	73
5120-00-999-1504	34	52
5120-00-999-1505	34	1
4910-00-999-1506	32	60
4910-00-999-1506	34	80
5305-01-010-2362	13	2
5305-01-010-2362	29	10
2940-01-019-4513	11	5
5305-01-028-8869	15	8
5360-01-038-4659	13	5
5330-01-040-2087	28	18
5330-01-046-0441	16	2
5330-01-046-1991	11	25
5330-01-046-3144	11	34
6620-01-047-2811	28	17
2815-01-048-6702	9	8
5330-01-049-0466	2	4
5330-01-051-4243	20	19
5330-01-052-9988	31	21
5315-01-058-4551	4	14
2910-01-065-3979	20	50
2940-01-065-7076	11	48
2930-01-065-7113	11	18
3030-01-065-9404	31	36
5340-01-066-2947	13	37
5330-01-066-3904	14	23
5330-01-066-3908	10	7
5330-01-066-3910	13	15
5330-01-066-5347	9	18
5330-01-066-5348	9	19
5330-01-066-5349	9	20
5330-01-066-5350	31	17
5330-01-066-5352	14	22
5330-01-066-5357	14	19
5330-01-069-1472	14	27
4720-01-070-8149	14	9
3020-01-070-8528	25	29
2910-01-070-9003	25	20
2910-01-070-9004	25	34
2950-01-071-5367	23	KIT
5330-01-071-7687	11	49
5120-01-072-2952	32	56
5120-01-072-2952	34	87
5120-01-072-2955	35	41
5330-01-072-4436	3	27
2930-01-072-8056	31	2

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5305-01-072-8826	20	70
5330-01-072-8828	25	8
5330-01-072-8829	25	33
5330-01-072-8830	25	38
5305-01-072-8831	25	48
5330-01-072-8982	20	18
5330-01-072-8983	20	69
5330-01-072-8998	14	4
5310-01-073-2854	23	5
4910-01-074-0020	35	62
5330-01-075-0948	26	KIT
2910-01-076-8632	19	23
2815-01-077-1482	6	14
2910-01-077-2016	19	21
3020-01-077-2229	4	11
3020-01-077-4411	4	4
2815-01-077-4463	15	11
2910-01-077-4976	19	2
5330-01-077-5228	11	30
2910-01-077-7303	19	5
4730-01-078-6364	20	53
6620-01-079-1632	4	3
3040-01-079-1748	13	13
3010-01-079-1788	13	22
2815-01-079-1799	8	34
2930-01-079-2239	31	12
4710-01-079-3198	28	10
4730-01-079-3274	23	30
4720-01-079-3285	13	31
2815-01-079-3298	3	20
2815-01-079-3317	29	16
2910-01-079-3320	20	16
2815-01-079-3321	1	4
2815-01-079-3380	7	9
4320-01-079-3454	31	18
3040-01-079-3468	31	31
3040-01-079-3469	13	30
4710-01-079-3487	23	29
4710-01-079-3493	21	12
3020-01-079-4206	31	32
5340-01-079-4678	19	14
3120-01-079-5208	8	12
3120-01-079-5451	9	14
5306-01-079-6506	19	17
5330-01-079-6514	11	36
3120-01-079-6527	15	9
5310-01-079-6529	19	12
5310-01-079-6708	19	24
5315-01-079-6740	4	10
3120-01-079-6823	2	26
5306-01-079-7027	6	5
5305-01-079-7028	19	25
5365-01-079-7142	20	54
5365-01-079-7142	25	51
4730-01-079-7459	28	4
3110-01-079-8190	20	67
3120-01-079-8194	7	7
5365-01-079-8373	20	55
2815-01-079-9146	16	24
5365-01-080-0409	31	28

NATIONAL STOCK NUMBER	FIGURE NO.	ITEM NO.
2815-01-080-0642	3	23
3040-01-080-1529	25	12
5330-01-080-1773	28	5
5330-01-080-2992	31	6
5330-01-080-2992	31	26
2910-01-080-3149	20	68
3120-01-080-3275	20	25
2520-01-080-4473	11	6
5330-01-080-5021	3	33
3120-01-080-5482	9	7
2910-01-080-5570	20	34
5340-01-080-6654	29	11
5305-01-081-0474	21	21
5365-01-081-0662	25	19
5330-01-082-1906	7	5
5330-01-082-6984	14	38
5330-01-082-6985	5	2
2815-01-083-2123	29	8
2815-01-083-3157	4	9
3120-01-083-6411	31	5
7530-01-083-7892	1	5
2910-01-084-0243	27	12
2815-01-084-3447	1	1
5305-01-084-4596	35	3
5355-01-084-5323	35	37
5133-01-084-6008	35	13
5133-01-084-6009	35	15
6620-01-084-6011	28	15
4910-01-084-6977	35	38
4910-01-084-6978	35	39
4910-01-084-6979	35	30
3020-01-084-7007	35	6
4910-01-084-7221	35	36
4910-01-084-7222	35	35
5365-01-084-9033	13	23
5360-01-084-9066	18	22
5330-01-084-9067	8	33
5330-01-084-9068	26	19
3020-01-084-9640	13	14
4910-01-085-0751	35	29
3020-01-085-0761	35	5
3120-01-085-0762	35	2
4910-01-085-0763	35	4
4910-01-085-0764	35	11
4910-01-085-0765	35	12
4910-01-085-0766	35	14
4910-01-085-1011	35	1
4720-01-085-1316	23	28
2990-01-085-1622	23	15
2815-01-085-1881	5	11
2815-01-085-2569	8	1
2910-01-085-2570	26	3
4720-01-085-2571	11	8
2990-01-085-2572	23	1
2815-01-085-2573	13	1
2815-01-085-2574	18	1
2990-01-085-2607	23	18
2815-01-085-2618	3	25
3040-01-085-2732	17	19
6680-01-085-2870	25	31

NATIONAL STOCK NUMBER	FIGURE NO.	ITEM NO.
6680-01-085-2871	25	4
5330-01-085-3105	18	6
6620-01-085-3579	28	1
2950-01-085-3580	23	16
4930-01-085-3728	35	31
2815-01-085-3733	3	16
2815-01-085-3734	13	8
3020-01-085-3779	13	41
2530-01-085-4153	25	32
4730-01-085-4156	28	7
5940-01-085-4426	18	11
5340-01-085-4439	18	23
2990-01-085-4768	23	21
2815-01-085-5190	9	25
2910-01-085-5339	25	1
2520-01-085-6128	8	30
4720-01-085-6129	28	9
4710-01-085-6130	11	31
4720-01-085-6131	14	6
4720-01-085-6131	14	31
4730-01-085-6132	14	7
4710-01-085-6134	21	18
4730-01-085-6269	13	35
4720-01-085-6293	23	11
4910-01-085-7269	35	34
4730-01-085-7328	15	3
4910-01-085-7824	35	28
2910-01-085-8096	2	9
5305-01-085-8197	11	12
5305-01-085-8197	28	3
5305-01-085-8197	29	14
2815-01-085-8282	3	3
4730-01-085-9119	29	12
4910-01-085-9211	32	1
4910-01-085-9211	34	85
4710-01-085-9348	21	22
4710-01-085-9349	21	20
5330-01-086-1013	18	5
2815-01-086-1422	6	11
2950-01-086-1447	23	34
2815-01-086-1448	23	4
2910-01-086-1449	20	75
2910-01-086-1651	20	21
2910-01-086-1679	20	12
2815-01-086-2704	6	KIT
3020-01-086-3417	31	3
5330-01-086-3523	14	45
5310-01-086-3948	18	24
2910-01-086-3974	19	15
2815-01-086-3975	9	4
2910-01-086-3983	20	22
5330-01-086-3991	31	29
5330-01-086-3996	18	25
2815-01-086-4508	6	1
5330-01-086-6112	7	4
5360-01-086-6113	20	56
5360-01-086-6114	20	39
5315-01-086-6187	7	10
5340-01-086-6193	3	24
5330-01-086-6196	18	8
5330-01-086-6197	11	17
5330-01-086-6203	29	13
5365-01-086-6759	2	6
5305-01-086-7036	11	26
5305-01-086-7036	28	6
5330-01-086-7257	16	13
5305-01-086-7285	19	1
5365-01-086-7680	2	6
2910-01-086-7715	25	3
5365-01-086-7788	16	14
5330-01-086-7790	31	KIT
5365-01-086-8214	2	6
4910-01-086-8268	35	9
3020-01-086-8269	35	7
4730-01-086-8652	29	17
3020-01-086-8780	25	7
2815-01-086-9757	9	11
4910-01-086-9766	35	63
5340-01-087-0681	3	30
5340-01-087-0682	3	29
3120-01-087-2539	25	5
3120-01-087-3004	6	6
2815-01-087-4740	27	KIT
5365-01-087-8727	18	10
2930-01-087-8749	29	3
3010-01-088-5727	25	21
3120-01-088-5821	4	KIT
2990-01-088-5922	25	23
5305-01-088-6019	29	2
2815-01-088-7328	18	20
4910-01-088-7904	35	10
4810-01-089-0534	18	3
5360-01-089-1367	18	13
4820-01-089-3939	18	12
5360-01-089-9103	18	14
5120-01-091-0689	32	54
5120-01-091-0689	34	67
5120-01-091-0690	32	53
5120-01-091-0690	34	71
5305-01-091-2498	17	9
2910-01-091-7507	20	63
5120-01-092-3275	33	32
5120-01-092-3275	35	84
5330-01-092-4143	31	KIT
4310-01-092-9815	17	11
4310-01-092-9816	17	14
2815-01-092-9817	16	7
2910-01-092-9818	25	2
5120-01-093-3382	33	31
5120-01-093-3382	35	83
7690-01-094-6720	1	7
5360-01-095-3661	25	26
5365-01-095-5666	17	2
2930-01-096-9035	31	1
2815-01-096-9198	8	25
2930-01-096-9199	31	25
2910-01-096-9200	22	4
5355-01-097-0157	35	33
5120-01-097-3204	33	29
5120-01-097-3204	35	95

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5365-01-097-5766	31	11	4910-01-097-6964	35	72
2930-01-097-6755	17	5	4910-01-097-6965	33	10
4910-01-097-6909	35	17	4910-01-097-6965	35	78
4910-01-097-6910	34	13	4910-01-097-6966	33	14
4910-01-097-6911	34	17	4910-01-097-6966	35	71
4910-01-097-6912	34	15	4910-01-097-6967	33	13
4910-01-097-6913	34	90	4910-01-097-6967	35	81
4910-01-097-6914	35	27	4910-01-097-6968	33	12
4910-01-097-6915	34	6	4910-01-097-6968	35	80
4910-01-097-6916	35	20	4910-01-097-6969	32	21
4910-01-097-6917	35	21	4910-01-097-6969	34	95
4910-01-097-6918	35	22	4910-01-097-6970	32	18
4910-01-097-6919	35	19	4910-01-097-6970	34	93
4910-01-097-6920	35	24	4910-01-097-6971	32	28
4910-01-097-6921	35	25	4910-01-097-6971	34	8
4910-01-097-6922	35	45	4910-01-097-6972	32	29
4910-01-097-6923	35	44	4910-01-097-6972	34	54
4910-01-097-6924	35	42	4910-01-097-6973	32	32
4610-01-097-6925	35	46	4910-01-097-6973	34	78
4910-01-097-6926	35	48	4910-01-097-6974	32	33
4910-01-097-6927	35	49	4910-01-097-6974	34	77
4910-01-097-6928	35	50	4910-01-097-6975	32	34
4910-01-097-6929	32	57	4910-01-097-6975	34	76
4810-01-097-6930	32	74	4910-01-097-6976	33	23
4910-01-097-6930	34	53	4910-01-097-6976	35	99
4910-01-097-6932	35	51	4910-01-097-6977	32	36
4910-01-097-6933	35	53	4910-01-097-6977	34	56
4910-01-097-6934	35	52	4910-01-097-6978	32	37
4910-01-097-6935	35	54	4910-01-097-6978	34	57
4910-01-097-6936	35	59	4910-01-097-6979	32	39
4910-01-097-6937	35	60	4910-01-097-6979	34	59
4910-01-097-6938	35	61	4910-01-097-6980	32	44
4910-01-097-6939	34	37	4910-01-097-6980	34	64
4910-01-097-6940	34	34	4910-01-097-6981	32	43
4910-01-097-6941	34	35	4910-01-097-6981	34	63
4910-01-097-6942	34	36	4910-01-097-6982	32	42
4910-01-097-6943	34	33	4910-01-097-6982	34	62
4910-01-097-6944	35	56	4910-01-097-6983	32	41
4910-01-097-6945	35	57	4910-01-097-6983	34	61
4910-01-097-6948	32	58	4910-01-097-6984	32	38
4910-01-097-6948	34	86	4910-01-097-6984	34	58
4910-01-097-6955	32	5	4910-01-097-6985	32	40
4910-01-097-6955	34	23	4910-01-097-6985	34	60
4910-01-097-6956	32	8	4910-01-097-6986	32	45
4910-01-097-6956	34	26	4910-01-097-6986	34	89
4910-01-097-6957	34	29	4910-01-097-6987	32	46
5910-01-097-6957	32	11	4910-01-097-6987	34	104
4910-01-097-6958	32	13	4910-01-097-6988	32	47
4910-01-097-6958	34	31	4910-01-097-6988	34	103
4910-01-097-6959	33	19	4910-01-097-6989	32	48
4910-01-097-6959	35	92	4910-01-097-6989	34	88
4910-01-097-6960	33	9	5355-01-097-7072	35	32
4910-01-097-6960	35	76	5305-01-097-9886	27	3
4910-01-097-6961	33	5	2930-01-098-0175	17	1
4910-01-097-6961	35	73	4910-01-098-1912	35	8
4910-01-097-6962	33	8	4910-01-098-1913	35	23
4910-01-097-6962	35	77	4910-01-098-1914	32	62
4910-01-097-6963	33	11	4910-01-098-1914	34	42
4910-01-097-6963	35	79	4910-01-098-1915	34	19
4910-01-097-6964	33	4	4910-01-098-1916	34	18

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4910-01-098-1917	34	11
4910-01-098-1918	34	16
4910-01-098-1919	34	14
4910-01-098-5088	32	10
4910-01-098-5088	34	28
2910-01-098-5094	20	23
2815-01-098-6755	18	21
5310-01-099-0389	27	17
4910-01-099-1487	32	67
4910-01-099-1487	34	48
5210-01-099-6339	32	4
5210-01-099-6339	34	22
5120-01-099-6340	32	55
5120-01-099-6340	34	68
5120-01-099-6341	32	27
5120-01-099-6341	34	102
5305-01-100-0135	35	66
5305-01-100-0136	35	65
5120-01-100-0137	32	23
5120-01-100-0137	34	98
4910-01-100-6191	34	12
5310-01-102-3270	27	10
5180-01-102-8418	34	32
5365-01-103-7835	32	22
5365-01-103-7835	34	96
3120-01-103-8752	32	24
3120-01-103-8752	34	99
3020-01-104-2334	13	27
5310-01-104-4549	32	7
5310-01-104-4549	34	25
5310-01-104-4550	32	25
5310-01-104-4550	34	100
2815-01-105-8768	2	12
4910-01-105-9165	35	26
4730-01-106-0202	5	17
4730-01-106-0202	13	7
4910-01-106-0492	35	18
4730-01-106-4700	26	16
4710-01-106-8068	21	16
5120-01-106-9173	33	30
5120-01-106-9173	35	94
5120-01-106-9174	33	28
5120-01-106-9174	35	96
5330-01-107-1841	35	55
6680-01-108-7410	12	14
4910-01-108-9130	32	70
4910-01-108-9130	34	45
5307-01-109-5972	8	4
4730-01-109-8501	21	19
5315-01-110-7835	32	65
5315-01-110-7835	34	50
5365-01-112-4281	11	44
5310-01-112-4306	16	27
2910-01-112-5797	27	2
4910-01-112-7509	32	63
4910-01-112-7509	34	43
2910-01-112-7712	19	3
4910-01-113-1066	32	64
4910-01-113-1066	34	44
6140-01-114-7119	18	4
5305-01-114-9279	28	14
5310-01-114-9279	11	32
5310-01-114-9279	25	10
4910-01-117-4885	32	68
4910-01-117-4885	34	47
4910-01-118-2878	32	69
4910-01-118-2878	34	46
4910-01-118-3747	34	38
5305-01-118-8826	10	2
5120-01-119-2743	32	66
5120-01-119-2743	34	49
5306-01-119-4271	17	21
5305-01-119-8621	17	22
2990-01-120-2883	7	3
5120-01-120-3681	35	40
5120-01-120-3682	32	19
5120-01-120-3682	34	94
5120-01-120-5759	35	16
5120-01-120-5760	34	41
5305-01-121-0355	11	38
2910-01-121-8859	24	10
2815-01-122-4010	3	11
5120-01-122-6014	32	51
5120-01-122-6014	34	70
2815-01-122-8002	5	3
2815-01-124-0232	17	15
4730-01-124-0293	8	32
5310-01-124-6463	17	30
5310-01-126-1045	17	29
5310-01-126-9404	12	15
5930-01-127-2113	27	16
4730-01-128-4598	2	25
2990-01-129-4302	17	23
5305-01-129-4386	31	35
5330-01-129-6541	17	32
5305-01-130-6100	7	1
5365-01-132-1984	31	9
2815-01-133-2445	12	7
5340-01-135-7250	28	12
5340-01-140-7158	12	21
2910-01-141-4029	20	9
4710-01-142-1667	12	29
2815-01-142-1732	10	5
5330-01-142-2784	20	10
5310-01-142-2812	20	15
2910-01-142-7455	20	14
4730-01-142-8524	21	5
5305-01-143-8112	29	20
5310-01-144-6115	1	3
5310-01-144-6115	17	6
5310-01-144-6115	18	26
5310-01-144-7368	17	17
5310-01-145-0761	20	11
5310-01-145-0762	31	24
5305-01-145-0776	17	8
5340-01-145-1181	27	7
5340-01-145-1597	30	7
5330-01-145-7550	16	8
5305-01-145-8382	17	4
5305-01-145-8383	17	28

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5310-01-145-8405	17	3
2815-01-146-1024	10	6
2815-01-146-1042	9	26
2910-01-146-1048	24	5
4730-01-146-1059	27	11
4730-01-146-3111	12	10
3020-01-146-3163	17	26
4730-01-146-3633	21	17
3020-01-146-3773	17	31
4720-01-146-4126	27	6
5310-01-146-6147	27	1
5310-01-146-7303	27	14
5330-01-146-7314	29	15
5330-01-146-7314	31	10
5340-01-146-9816	27	18
5305-01-147-4035	31	33
5365-01-147-5030	17	7
3120-01-147-5275	17	13
5306-01-151-1023	27	5
4820-01-158-0555	21	KIT
2815-01-160-5820	5	5
5120-01-160-8863	32	72
2815-01-164-6103	10	4
4730-01-165-0749	30	8
2815-01-168-3742	6	17
5220-01-168-6878	34	105
2930-01-184-1877	30	KIT
5306-01-204-3297	21	15
4820-01-210-9571	29	7
5120-01-865-0226	34	72

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15434	AC1600300NF	4720-01-085-1316	23	28
88044	AN737TW22	4730-00-278-9200	21	2
88044	AN906-416	5310-00-141-1795	25	47
88044	AN960-416	5310-00-141-1795	20	5
88044	AN960-416	5310-00-041-1795	20	78
88044	AN960-416	5310-00-141-1795	26	11
15434	AR-2308	2815-00-005-7431	8	10
15434	AR-41019	2910-01-085-5339	25	1
15434	AR-45724	2990-01-129-4302	17	23
15434	AR03307	2815-01-085-2569	8	1
15434	AR05911		12	1
15434	AR07240	3120-01-088-5821	4	KIT
15434	AR09480		11	29
15434	AR09999		11	15
15434	AR10124	6620-01-085-3579	28	1
15434	AR10172	2815-01-085-2573	13	1
15434	AR11317	2815-00-011-7786	2	1
15434	AR11780	2815-01-085-5190	9	25
15434	AR12220	2910-01-085-2570	26	3
15434	AR12228		26	15
15434	AR12732	5330-00-005-0407	31	19
15434	AR12872		14	15
15434	AR40130		20	32
15434	AR41007	2910-01-092-9818	25	2
15434	AR41009	6680-01-085-2870	25	31
15434	AR41010	2910-01-080-3149	20	68
15434	AR41017		25	27
15434	AR41021	2910-01-098-5094	20	23
15434	AR41022	2910-01-086-3983	20	22
15434	AR45189	2930-01-096-9199	31	25
15434	AR51276	2810-00-195-5894	8	20
15434	AR51959		7	2
15434	AR8667		13	16
15434	AR9743	2815-01-092-9817	16	7
15434	AR9832	2815-01-085-3734	13	8
53496	A11	4730-00-555-8263	14	5
15434	BM65725	2910-00-455-1406	24	13
15434	BM66317	2815-01-085-1881	5	11
15434	BM67416	2910-00-132-0769	25	43
15434	BM69889	2910-00-803-2631	25	40
15434	BM69973	4810-00-695-3284	24	1
15434	BM94651	3040-00-449-7397	20	46
15434	BM95160	2815-00-195-5897	8	15
15434	BM95161	2815-01-096-9198	8	25
15434	BM95162	2815-00-851-7637	8	5
15434	BM97497	2910-01-096-9200	22	4
15434	BM97502	2910-00-869-3428	22	3
55719	B1465A	5120-01-093-3382	33	31
55719	B1465A	5120-01-093-3382	35	83
81348	F-40A	5120-00-288-6514	32	50
81348	F-40A	5120-00-298-6514	34	69
33457	FS1212	2910-00-174-5822	26	18
55883	IPD7H3171	4730-00-042-8988	2	28
55883	IPD7H3171	4730-00-042-8988	16	19
55883	IPD7H3171	4730-00-042-8988	20	57
33457	LF670	2940-01-019-4513	11	5
34623	M-B362-20001	5310-01-146-7303	27	14
15434	M-1302B-24	5120-01-091-0690	32	53
15434	M-1302B-24	5120-01-091-0690	34	71
34623	M/125-20027	4730-00-927-7272	13	17
34623	MA145B21000	4720-01-079-3285	13	31
34623	MA207-21139	2910-00-338-6839	12	5
34623	MA207-21542	2910-00-410-2268	20	44
34623	MA207-22712		16	15
34623	MA25-21056		30	6
34623	MA87-21005	2815-01-084-3447	1	1
96906	MS122032	5310-00-159-6209	14	12
96906	MS122032	5310-00-159-6209	14	34
96906	MS122032	5310-00-159-6209	20	42
96906	MS122032	5310-00-159-6209	21	14
96906	MS122032	5310-00-159-6209	22	2
96906	MS122032	5310-00-159-6209	23	13
96906	MS16632-1050	5365-00-256-2846	20	66
96906	MS18154-59	5305-01-010-2362	29	10
96906	MS20913-4S	4730-00-221-2139	29	9
96906	MS21333-98	5340-00-809-1490	27	9
96906	MS27183	5310-00-080-6004	14	14
96906	MS27183-14	5310-00-080-6004	12	18
96906	MS27183-14	5310-00-080-6004	13	25
96906	MS27183-14	5310-00-080-6004	16	16
96906	MS35338-45	5310-00-407-9566	11	33
96906	MS35338-45	5310-00-407-9566	25	11
96906	MS35338-45	5310-00-407-9566	28	13
96906	MS35338-46	5310-00-637-9541	12	20
96906	MS35338-46	5310-00-637-9541	13	32
96906	MS35338-46	5310-00-637-9541	14	3
96906	MS35338-46	5310-00-637-9541	16	17
96906	MS35338-46	5310-00-637-9541	21	7
96906	MS35338-47	5310-00-209-0965	25	14
96906	MS35338-47	5310-00-209-0965	25	16
96906	MS35338-48	5310-00-584-5272	1	2
96906	MS35338-48	5310-00-584-5272	5	7
96906	MS35338-48	5310-00-584-5272	11	11
96906	MS35338-8	5310-00-261-7340	12	16
96906	MS35338-8	5310-00-261-7340	12	28
96906	MS35338-8	5310-00-261-7340	28	2
96906	MS35338-8	5310-00-261-7340	29	18
96906	MS35338-8	5310-00-261-7340	31	34
96906	MS35338-9	5310-00-010-3322	12	25
96906	MS35691-5	5310-00-971-7989	20	8
96906	MS35691-5	5310-00-971-7989	20	49
96906	MS35756-34	5310-00-043-1787	13	11
96906	MS35842-10	4730-00-908-3195	30	4
96906	MS35842-13	4730-00-909-8627	28	8
96906	MS39158-3	4730-00-900-3296	21	23
96906	MS39254	2910-00-646-9727	27	8
96906	MS51092-1	5310-00-684-3463	14	26
96906	MS51095-374	5305-00-964-0565	13	24
96906	MS51875-10	4730-00-289-1935	29	21
96906	MS51884-5	4730-00-010-3867	11	28
96906	MS51884-5	4730-00-010-3867	12	3
96906	MS51884-5	4730-00-010-3867	16	3
96906	MS51884-5	4730-00-010-3867	31	14
96906	MS51967-20	5310-00-763-8920	31	23
96906	MS51968-14	5310-00-732-0560	8	3
96906	MS90725-100	5305-00-069-5584	12	26
96906	MS90725-34	5306-00-225-8499	14	17
15434	MS90725-36	5305-00-225-9081	13	26
96906	MS90725-59	5305-01-010-2362	13	2
96906	MS90725-60	5305-00-269-3211	12	19

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96906	MS90725-60	5305-00-269-3211	14	33
96906	MS90725-64	5305-00-269-3214	14	2
96906	MS90725-64	5305-00-269-3214	14	11
96906	MS9241-024	5330-00-924-7757	19	19
15434	M1302B18	5120-01-091-0689	32	54
15434	M1302B18	5120-01-091-0689	34	67
15434	S-151C		21	9
15434	S-156-B	5305-01-081-0474	21	21
15434	S-2286	5305-00-804-6318	1	6
15434	ST-1032	5120-00-896-8087	34	3
15434	ST-1059-17	5120-01-120-5760	34	41
15434	ST-1065	5120-00-150-7489	34	40
15434	ST-1090	5120-01-072-2955	35	41
15434	ST-1090-3	4910-01-097-6923	35	44
15434	ST-1090-4	4910-01-097-6924	35	42
15434	ST-1095	5120-00-116-7625	35	68
15434	ST-1100	5120-00-178-0948	33	3
15434	ST-1100	5120-00-178-0948	35	70
15434	ST-1100-1		33	7
15434	ST-1100-10	4910-01-097-6964	33	4
15434	ST-1100-10	4910-01-097-6964	35	72
15434	ST-1100-11	4910-01-097-6965	33	10
15434	ST-1100-11	4910-01-097-6965	35	78
15434	ST-1100-12	4910-01-097-6966	33	14
15434	ST-1100-12	4910-01-097-6966	35	71
15434	ST-1100-13	4910-01-097-6967	33	13
15434	ST-1100-13	4910-01-097-6967	35	81
15434	ST-1100-14	4910-01-097-6968	33	12
15434	ST-1100-14	4910-01-097-6968	35	80
15434	ST-1100-4		35	75
15434	ST-1100-5		33	6
15434	ST-1100-5		35	74
15434	ST-1100-6	4910-01-097-6960	33	9
15434	ST-1100-6	4910-01-097-6960	35	76
15434	ST-1100-7	4910-01-097-6961	33	5
15434	ST-1100-7	4910-01-097-6961	35	73
15434	ST-1100-8	4910-01-097-6962	33	8
15434	ST-1100-8	4910-01-097-6962	35	77
15434	ST-1100-9	4910-01-097-6963	33	11
15434	ST-1100-9	4910-01-097-6963	35	79
15434	ST-1114	4910-01-097-6987	32	46
15434	ST-1114	4910-01-097-6987	34	104
15434	ST-1145	4610-01-097-6925	35	46
15434	ST-1157	4910-01-097-6913	34	90
15434	ST-1158	4910-01-097-6914	35	27
15434	ST-1159	4910-01-097-6988	32	47
15434	ST-1159	4910-01-097-6988	34	103
15434	ST-1168	4910-01-085-1011	35	1
15434	ST-1168-10	3020-01-086-8269	35	7
15434	ST-1168-19	4910-01-098-1912	35	8
15434	ST-1168-3	4910-01-085-0763	35	4
15434	ST-1168-4	3120-01-085-0762	35	2
15434	ST-1168-5	3020-01-085-0761	35	5
15434	ST-1168-6	5305-01-084-4596	35	3
15434	ST-1168-7	3020-01-084-7007	35	6
15434	ST-1168-8	4910-01-086-8268	35	9
15434	ST-1168-9	4910-01-088-7904	35	10
15434	ST-1177		34	106
15434	ST-1179	5120-00-104-1795	32	15
15434	ST-1179	5120-00-104-1795	34	91

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15434	ST-1218	4910-01-097-6976	33	23
15434	ST-1218	4910-01-097-6976	35	99
15434	ST-1227	5120-00-981-3108	32	16
15434	ST-1227	5120-00-981-3108	34	79
15434	ST-1228	5120-00-055-4013	34	10
15434	ST-1228-1	4910-01-098-1915	34	19
15434	ST-1228-13	4910-01-097-6910	34	13
15434	ST-1228-14	4910-01-097-6911	34	17
15434	ST-1228-2	4910-01-098-1916	34	18
15434	ST-1228-3	4910-01-098-1917	34	11
96906	ST-1228-4	4910-01-098-1918	34	16
15434	ST-1228-5	4910-01-098-1919	34	14
15434	ST-1228-9	4910-01-100-6191	34	12
15434	ST-1242	4910-01-098-1914	32	62
15434	ST-1242	4910-01-098-1914	34	42
15434	ST-1242-1	4910-01-108-9130	32	70
15434	ST-1242-1	4910-01-108-9130	34	45
15434	ST-1242-2	4910-01-113-1066	32	64
15434	ST-1242-2	4910-01-113-1066	34	44
15434	ST-1242-3	4910-01-112-7509	32	63
15434	ST-1242-3	4910-01-112-7509	34	43
15434	ST-1242-4	5120-01-119-2743	32	66
15434	ST-1242-4	5120-01-119-2743	34	49
15434	ST-1242-5	4910-01-099-1487	32	67
15434	ST-1242-5	4910-01-099-1487	34	48
15434	ST-1242-6	5315-01-110-7835	32	65
15434	ST-1242-6	5315-01-110-7835	34	50
15434	ST-1242-7	4910-01-117-4885	32	68
15434	ST-1242-7	4910-01-117-4885	34	47
15434	ST-1242-8	4910-01-118-2878	32	69
15434	ST-1242-8	4910-01-118-2878	34	46
15434	ST-1244	5120-00-113-5271	32	17
15434	ST-1244	5120-00-113-5271	34	92
15434	ST-1244-1	5120-01-100-0137	32	23
15434	ST-1244-1	5120-01-100-0137	34	98
15434	ST-1244-3		32	26
15434	ST-1244-3		34	101
15434	ST-1244-4	5310-01-104-4550	32	25
15434	ST-1244-4	5310-01-104-4550	34	100
15434	ST-1244-5	3120-01-103-8752	32	24
15434	ST-1244-5	3120-01-103-8752	34	99
15434	ST-1244-8	5120-01-099-6341	32	27
15434	ST-1244-8	5120-01-099-6341	34	102
15434	ST-1244-9	5365-01-103-7835	32	22
15434	ST-1244-9	5365-01-103-7835	34	96
15434	ST-1255	4910-01-085-0764	35	11
15434	ST-1259	4910-01-106-0492	35	18
15434	ST-1259-1	4910-01-097-6916	35	20
15434	ST-1259-2	4910-01-097-6917	35	21
15434	ST-1259-3	4910-01-097-6918	35	22
15434	ST-1259-4	4910-01-097-6919	35	19
15434	ST-1259-5	4910-01-097-6920	35	24
15434	ST-1259-6	4910-01-097-6921	35	25
15434	ST-1259-7	4910-01-098-1913	35	23
15434	ST-1287	4910-01-085-0765	35	12
15434	ST-1287-10	5133-01-084-6008	35	13
15434	ST-1318	4910-01-085-0766	35	14
15434	ST-1318-23	5133-01-084-6009	35	15
15434	ST-1325	4910-01-097-6972	32	29
15434	ST-1325	4910-01-097-6972	34	54

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FSCM	PART NUMBER	NATIONAL STOCK NUMBER	FIGURE NO.	ITEM NO.
15434	ST-1326	4910-01-097-6932	35	51
15434	ST-1326-1	4910-01-097-6933	35	53
15434	ST-1326-2	4910-01-097-6934	35	52
15434	ST-249	5180-00-916-1813	33	26
15434	ST-249	5180-00-916-1813	35	93
15434	ST-249-1	5120-01-106-9173	33	30
15434	ST-249-1	5120-01-106-9173	35	94
15434	ST-249-2	5120-01-097-3204	33	29
15434	ST-249-2	5120-01-097-3204	35	95
15434	ST-249-3	5120-01-106-9174	33	28
15434	ST-249-3	5120-01-106-9174	35	96
15434	ST-249-4		33	27
15434	ST-249-4		35	97
15434	ST-302	4910-00-999-1506	32	60
15434	ST-302	4910-00-999-1506	34	80
15434	ST-386	5180-00-944-0374	32	35
15434	ST-386	5180-00-944-0374	34	55
15434	ST-386-10	4910-01-097-6983	32	41
15434	ST-386-10	4910-01-097-6983	34	61
15434	ST-386-11	4910-01-097-6984	32	38
15434	ST-386-11	4910-01-097-6984	34	58
15434	ST-386-2	4910-01-097-6977	32	36
15434	ST-386-2	4910-01-097-6977	34	56
15434	ST-386-3	4910-01-097-6978	32	37
15434	ST-386-3	4910-01-097-6978	34	57
15434	ST-386-5	4910-01-097-6979	32	39
15434	ST-386-5	4910-01-097-6979	34	59
15434	ST-386-6	4910-01-097-6980	32	44
15434	ST-386-6	4910-01-097-6980	34	64
15434	ST-386-8	4910-01-097-6981	32	43
15434	ST-386-8	4910-01-097-6981	34	63
15434	ST-386-9	4910-01-097-6982	32	42
15434	ST-386-9	4910-01-097-6982	34	62
15434	ST-419	5120-00-896-8097	32	59
15434	ST-419	5120-00-896-8097	34	81
15434	ST-442	5120-00-896-8089	35	47
15434	ST-490	5110-00-981-3107	34	51
15434	ST-544	5120-00-065-1031	35	64
15434	ST-544-1	5305-01-100-0135	35	66
15434	ST-544-2	5305-01-100-0136	35	65
15434	ST-560	5120-00-999-1209	32	61
15434	ST-560	5210-00-999-1209	34	74
15434	ST-593	4910-00-712-0537	33	1
15434	ST-593	4910-00-712-0537	35	69
15434	ST-608	4910-01-086-9766	35	63
15434	ST-633	4910-00-150-5797	32	30
15434	ST-633	4910-00-150-5797	34	73
15434	ST-646	5110-00-980-7347	33	2
15434	ST-646	5110-00-980-7347	35	82
15434	ST-658	4910-01-097-6986	32	45
15434	ST-658	4910-01-097-6986	34	89
15434	ST-659	5120-00-159-8916	33	24
15434	ST-659	5120-00-159-8916	35	98
15434	ST-669	5120-00-103-4687	32	49
15434	ST-669	5120-00-103-4687	34	66
15434	ST-669-13	5120-01-122-6014	32	51
15434	ST-669-13	5120-01-122-6014	34	70
15434	ST-691	3460-00-999-1210	32	31
15434	ST-691	3460-00-999-1210	34	75
15434	ST-691-1	4910-01-097-6973	32	32
15434	ST-691-1	4910-01-097-6973	34	78
15434	ST-691-2	4910-01-097-6974	32	33
15434	ST-691-2	4910-01-097-6974	34	77
15434	ST-691-3	4910-01-097-6975	32	34
15434	ST-691-3	4910-01-097-6975	34	76
15434	ST-699-1	5120-01-099-6340	34	68
15434	ST-6991	5120-01-099-6340	32	55
15434	ST-709	5120-00-999-1504	32	73
15434	ST-709	5120-00-999-1504	34	52
15434	ST-788	5110-00-932-2089	34	20
15434	ST-835	5120-00-999-1505	34	1
15434	ST-851	5120-00-923-0856	35	67
15434	ST-853	4910-00-150-5801	34	2
15434	ST-880	3441-00-922-6699	34	21
15434	ST-880-1	5210-01-099-6339	32	4
15434	ST-880-1	5210-01-099-6339	34	22
15434	ST-880-2	4910-01-097-6955	32	5
15434	ST-880-2	4910-01-097-6955	34	23
15434	ST-880-3		32	6
15434	ST-880-3		34	24
15434	ST-880-6	5310-01-104-4549	32	7
15434	ST-880-6	5310-01-104-4549	34	25
15434	ST-880-7	4910-01-097-6956	32	8
15434	ST-880-7	4910-01-097-6956	34	26
15434	ST-884	5910-00-981-3105	32	9
15434	ST-884	4910-00-981-3105	34	27
15434	ST-884-1	5910-01-097-6957	32	11
15434	ST-884-1	4910-01-097-6957	34	29
15434	ST-884-3	4910-01-098-5088	32	10
15434	ST-884-3	4910-01-098-5088	34	28
15434	ST-884-5		32	12
15434	ST-884-5		34	30
15434	ST-884-6	4910-01-097-6958	32	13
15434	ST-884-6	4910-01-097-6958	34	31
15434	ST-903	5220-01-168-6878	34	105
15434	ST-913	4910-00-999-1499	33	15
15434	ST-913	4910-00-999-1499	35	85
15434	ST-913-1		33	20
15434	ST-913-1		35	86
15434	ST-913-11		33	22
15434	ST-913-11		35	88
15434	ST-913-14		33	18
15434	ST-913-14		35	91
15434	ST-913-17	4910-01-097-6959	33	19
15434	ST-913-17	4910-01-097-6959	35	92
15434	ST-913-18		33	16
15434	ST-913-18		35	89
15434	ST-913-23		33	17
15434	ST-913-23		35	90
15434	ST-913-7		33	21
15434	ST-913-7		35	87
15434	ST-981	4910-01-097-6922	35	45
15434	ST-995	5120-00-150-7492	32	71
15434	ST-995	5120-00-150-7492	34	4
15434	ST-997	4910-00-150-5810	34	5
15434	ST-997-6	4910-01-097-6915	34	6
55719	STMD-8	5120-01-092-3275	33	32
55719	STMD-8	5120-01-092-3275	35	84
15434	ST1225	4910-01-097-6948	32	58
15434	ST1225	4910-01-097-6948	34	86

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FSCM	PART NUMBER	NATIONAL STOCK NUMBER	FIGURE NO.	ITEM NO.
15434	ST788	5110-00-932-2089	32	2
15434	ST880	3441-00-922-6699	32	3
15434	S103D	5305-00-269-3213	11	35
15434	S103D	5305-00-269-3213	13	20
15434	S103D	5305-00-269-3213	14	25
15434	S103D	5305-00-269-3213	16	18
15434	S105	5305-00-426-4142	13	33
15434	S105	5305-00-426-4142	20	76
15434	S105	5305-00-426-4142	25	50
15434	S105	5305-00-426-4142	26	1
15434	S106C	5305-01-121-0355	11	38
15434	S109	5305-00-851-5992	21	4
15434	S110	5310-01-114-9279	11	32
15434	S110	5310-01-114-9279	25	10
15434	S110	5305-01-114-9279	28	14
15434	S118A	5305-00-230-1939	23	12
15434	S119C		16	21
15434	S126	5305-00-177-5552	12	13
15434	S129	5306-00-546-6698	9	1
15434	S130A	5305-00-206-4527	29	19
15434	S1354	5305-00-804-6454	12	4
15434	S145	5305-00-782-9495	11	10
15434	S145C		14	36
15434	S149A	5305-00-404-1390	14	13
15434	S151		25	13
15434	S152B		11	45
15434	S155	5305-01-028-8869	15	8
15434	S159-B	5305-00-493-3959	20	43
15434	S16052	3110-00-516-5289	25	18
15434	S16073	3110-00-144-8519	31	8
15434	S16255	2815-00-815-0355	31	7
15434	S16255	2815-00-815-0355	31	27
15434	S168C	5305-00-018-6494	20	2
15434	S174C	5305-00-207-2715	26	10
15434	S186A		14	43
15434	S189B		5	14
15434	S189C	5305-00-509-8106	24	4
15434	S200	5310-00-469-3998	5	18
15434	S222A	5310-00-164-1904	23	19
15434	S223	5310-00-521-8595	13	39
15434	S223	5310-00-521-8595	14	40
15434	S223	5310-00-521-8595	21	8
15434	S2286	5305-00-804-6318	20	51
15434	S2286	5305-00-804-6318	23	2
15434	S248	5310-00-005-6052	20	65
15434	S253		20	13
15434	S285	5310-00-470-6154	17	10
15434	S2876	2930-00-353-9164	20	48
15434	S600	5310-00-562-6552	26	12
15434	S601	5310-00-134-4168	5	6
15434	S603	5310-00-232-8194	14	42
15434	S604	5310-00-261-7340	9	2
15434	S606	5310-00-410-6756	20	6
15434	S609	5310-00-873-1153	21	10
15434	S610	5310-00-209-0965	13	18
15434	S610	5310-00-209-0965	16	5
15434	S622	5310-00-562-6557	13	19
15434	S622	5310-00-562-6557	16	6
15434	S631	5310-00-562-6560	21	13
15434	S631	5310-00-562-6560	23	8

FSCM	PART NUMBER	NATIONAL STOCK NUMBER	FIGURE NO.	ITEM NO.
15434	S684	5330-00-003-1771	14	16
15434	S684	5330-00-003-1771	14	32
15434	S689		21	11
15434	S911B	4730-00-018-9566	2	32
15434	S911B	4730-00-018-9566	3	22
15434	S911B	4730-00-018-9566	5	20
15434	S911B	4730-00-018-9566	11	24
15434	S911B	4730-00-018-9566	17	24
15434	S911B	4730-00-018-9566	31	16
15434	S915A	4730-00-801-8186	2	17
15434	S965E	5365-00-404-2934	3	5
15434	S966E		2	18
15434	TM-82	5120-00-865-0226	32	52
15434	TM-82	5120-01-865-0226	34	72
91265	TS33-016	5330-00-951-3538	24	12
75078	001022	5360-01-084-9066	18	22
75078	001023	5365-01-087-8727	18	10
75078	001026		18	7
75078	001030	5310-01-145-8405	17	3
75078	001030		18	18
75078	001031		18	9
75078	001081	5330-01-086-1013	18	5
75078	001082	5330-01-085-3105	18	6
75078	001083	5330-01-086-6196	18	8
75078	001094	5310-01-144-6115	1	3
75078	001094	5310-01-144-6115	17	6
75078	001094	5310-01-144-6115	18	26
75078	001188	2815-01-085-3733	3	16
75078	001234	5365-01-147-5030	17	7
75078	001265		18	16
75078	001492		18	17
75078	001519	5360-01-089-9103	18	14
75078	001521	4820-01-089-3939	18	12
75078	002299	5940-01-085-4426	18	11
75078	002390	6140-01-114-7119	18	4
75078	002680	5310-01-086-3948	18	24
75078	002969	2520-01-085-6128	8	30
75078	003251	5365-01-095-5666	17	2
75078	003252	5305-01-145-8382	17	4
75078	004089	2815-01-088-7328	18	20
75078	004136		18	15
75078	004205	4810-01-089-0534	18	3
75078	005342		18	2
75078	006999	2815-01-085-2574	18	1
75078	007447		18	19
75078	007500	5360-01-089-1367	18	13
75078	007623	2815-01-098-6755	18	21
75078	008895	5340-01-085-4439	18	23
15434	100099	5330-00-809-2667	26	7
15434	100129	5305-00-721-3698	22	1
15434	100193	3120-00-810-6032	20	30
15434	100215	2910-00-567-4354	22	14
15434	100475	5365-01-084-9033	13	23
15434	100478	5330-00-081-9289	20	71
15434	100764	5330-00-506-4866	25	22
06991	101037-05	5306-01-151-1023	27	5
15434	101322	2815-00-590-7378	10	1
15434	101486	3120-00-719-5719	22	16
15434	101841	5365-00-507-3224	20	33
15434	101842	5365-00-507-3225	20	33

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FSCM	PART NUMBER	NATIONAL STOCK NUMBER	FIGURE NO.	ITEM NO.
15434	101843	5365-00-543-3744	20	33
06991	102030	5310-01-146-6147	27	1
15434	102522	4720-01-085-6129	28	9
75078	10279	5330-01-086-3996	18	25
06991	103031		27	4
15434	105182	4730-01-085-6269	13	35
15434	105199	2815-00-829-5227	15	13
15434	105375	9905-00-733-7622	20	58
15434	105953	5306-00-804-2468	2	23
15434	106289	5305-00-091-4009	5	16
15434	107460	5340-00-087-7486	14	44
15434	107738	2815-00-505-5119	9	15
15434	107947	4820-00-276-9041	11	27
06991	108289	5340-01-146-9816	27	18
15434	108722	5340-00-400-3449	23	25
15434	109319	2815-00-406-8936	13	3
15434	109333	2815-00-705-2856	13	6
15434	109594	3120-01-079-6527	15	9
15434	109918	5305-00-550-4710	20	40
79470	110-03270	4730-01-086-8652	29	17
15434	110266	5305-00-477-0395	15	7
15434	110855	5330-00-567-3463	22	12
15434	114638	5310-00-887-8325	15	6
24617	115224	4730-00-196-0936	29	6
15434	116390	5310-00-081-9292	17	18
15434	116391	3120-00-792-9834	17	25
15434	116982	2815-00-767-4012	15	10
15434	117302	5365-01-097-5766	31	11
15434	117897		13	21
15434	118227	5315-00-014-1215	20	27
15434	118377	3120-00-791-1440	9	16
15434	118378	3120-00-659-7808	9	9
15434	118939	5315-00-777-3544	9	6
15434	118939	5315-00-777-3544	9	12
15434	119363	3020-00-702-3882	22	13
15434	1199		8	36
24617	120217		24	9
75078	1232		8	37
15434	123558	5315-00-866-5015	3	28
06991	125049	4730-01-146-1059	27	11
15434	126304	2815-00-828-7013	13	4
15434	127316	5310-00-081-8500	4	2
15434	127316	5310-00-081-8500	5	15
15434	127554	2815-00-994-4434	3	9
15434	127558	2815-00-791-1453	11	41
15434	127930	2815-00-085-7434	3	31
15434	128936	2815-00-406-6737	23	3
15434	129594		5	12
15434	129768	5310-00-082-1888	24	6
15434	129826	2990-00-829-5600	24	17
15434	129838	5355-00-082-1189	24	18
15434	129839	2910-00-084-7787	24	11
15434	129866	4730-01-106-4700	26	16
15434	129888	5330-00-081-9299	24	7
15434	130118	2930-00-928-3595	29	22
15434	130394	4730-00-404-2906	29	5
15434	131026	5330-00-143-8485	3	19
15434	132770	3120-00-877-2213	16	9
15434	133538		26	13
15434	134072	2910-01-121-8859	24	10
15434	134561		12	24
15434	137075	5330-00-452-1748	7	6
15434	137370	2815-00-907-8964	25	39
15434	137372	5315-00-907-0711	20	35
15434	137796	5306-01-204-3297	21	15
15434	138769	5360-01-086-6114	20	39
15434	138905	3120-00-764-7090	20	37
15434	139988	5330-00-809-3276	26	5
15434	140297	2815-01-079-1799	8	34
15434	140330	3120-00-589-3537	8	7
15434	140330	3120-00-589-3537	8	17
15434	140330	3120-00-589-3537	8	22
15434	140330	3120-00-589-3537	8	27
15434	142110		11	39
15434	142689	3020-00-160-9092	17	12
15434	143251	5360-00-461-5738	25	54
15434	143848	5360-01-095-3661	25	26
15434	143938	5365-00-485-9250	2	6
15434	143939	5365-00-488-0799	2	6
15434	143946	5365-00-487-1927	2	6
15434	143947	5365-01-086-8214	2	6
15434	143948	5365-01-086-6759	2	6
15434	143949	5365-01-086-7680	2	6
15434	144178	5315-00-082-0448	25	24
15434	144179	5310-00-727-8353	25	25
15434	144195	5360-00-082-0124	25	41
15434	144302	2910-00-829-5604	20	36
15434	145504	5330-01-051-4243	20	19
15434	145505	5330-01-072-8982	20	18
15434	145506	5330-01-086-3991	31	29
15434	145701	2815-00-962-5623	3	21
15434	146437	2910-00-451-8063	25	30
15434	146483	2910-00-790-8736	20	62
15434	147056	2815-00-085-7442	3	26
15434	147100	2910-00-928-3505	3	18
15434	147389	5305-00-062-4378	3	13
15434	147389	5305-00-062-4378	3	15
15434	147670	2815-00-994-4427	6	7
15434	151478	2815-00-920-2073	15	4
15434	151489	2815-00-920-8356	15	2
15434	151900	5330-00-080-0483	26	20
15434	153338	2910-00-829-5617	26	9
15434	153346		26	14
15434	154088	5330-00-961-9470	20	60
15434	15434		35	58
15434	155789	4720-01-085-6131	14	6
15434	155789	4720-01-085-6131	14	31
15434	156416	5340-00-103-9988	23	9
15434	156420	3120-00-682-7706	23	26
15434	156444	5330-00-237-6266	23	20
15434	157088	5365-00-507-3271	20	59
15434	157280	3120-00-936-8209	4	13
15434	157551	5330-00-143-8376	13	34
15434	160514	5365-00-965-0870	26	8
15434	162426	2910-00-112-7950	25	9
15434	163733	2910-00-400-5178	20	26
15434	163944	3120-00-904-9595	25	28
15434	166009	5360-00-132-0245	19	13
15434	166485	3120-00-493-3913	20	41
15434	166777	5305-01-091-2498	17	9

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FSCM	PART NUMBER	NATIONAL STOCK NUMBER	FIGURE NO.	ITEM NO.
15434	167157	2910-00-404-3054	19	16
15434	167299	5310-00-680-6874	23	7
15434	168306	5305-00-947-3437	8	2
15434	168803		8	16
15434	168805		8	21
15434	169704		8	26
15434	169705		8	6
15434	170296	2815-00-933-3009	3	8
15434	170510	5330-00-632-6182	23	24
15434	170664	5310-00-486-2507	17	20
15434	170970		21	6
15434	171570	2990-00-477-6159	23	32
15434	172034	2815-00-632-6239	3	6
15434	172648	5330-00-404-2920	5	4
15434	173086	5330-00-132-0247	19	22
15434	173368	5330-00-132-0248	11	23
15434	173708		20	47
15434	173717	5360-00-436-7340	20	45
15434	174299	5365-00-815-1137	19	20
15434	175831	5340-00-485-0945	9	21
15434	175833	5305-01-145-8383	17	28
15434	175836	4820-00-130-4820	22	11
15434	175860		22	7
15434	175864	2910-00-933-3012	22	15
15434	175867		22	6
75078	1764	5307-01-109-5972	8	4
15434	177419	3040-01-079-3469	13	30
15434	177999	4730-00-369-7824	25	49
15434	178074	5340-01-140-7158	12	21
15434	179063		11	22
15434	179834	5360-01-086-6113	20	56
15434	181213	4730-00-444-1710	3	4
15434	181466	5310-00-484-1718	20	77
15434	181466	5310-00-484-1718	22	10
15434	181466	5310-00-484-1718	24	3
15434	181466	5310-00-484-1718	26	2
15434	182706	5305-00-058-6604	31	22
15434	183049	5330-00-058-1767	2	5
15434	183913	5365-01-112-4281	11	44
15434	185138	5340-01-079-4678	19	14
15434	185573	5365-01-086-7788	16	14
15434	186780	5330-00-864-5422	28	16
15434	187420	2815-00-132-0273	6	2
15434	187556	5305-00-138-9848	24	8
15434	187670	3120-00-005-0601	4	7
15434	187680	3120-00-005-5882	4	12
15434	189848		19	10
15434	190397	2930-00-401-9531	17	27
15434	190849	5330-00-194-8385	23	6
15434	190876	5330-00-132-0274	20	64
15434	190876	5330-00-132-0274	24	15
15434	191916	2910-00-238-5435	19	4
15434	191970	2815-00-480-4347	6	13
15434	191970	2815-00-480-4347	6	16
15434	193136	5310-01-124-6463	17	30
15434	193625	2815-01-133-2445	12	7
15434	193734	5330-00-403-9896	20	20
15434	193736	5330-00-132-0276	19	18
15434	194010	5305-00-411-9340	23	10
15434	194037	2815-00-404-2940	8	9
15434	194037	2815-00-404-2940	8	14
15434	194037	2815-00-404-2940	8	19
15434	194037	2815-00-404-2940	8	24
15434	194037	2815-00-404-2940	8	29
15434	195190	3120-00-005-5883	4	5
15434	195200	3120-00-005-5884	4	17
15434	195210	3120-00-007-2901	4	6
15434	195220	3120-00-005-0602	4	15
15434	195840	5365-00-135-2166	23	33
15434	195952	5330-01-066-3904	14	23
15434	196037	4820-00-084-7813	24	14
15434	196282	4730-01-085-4156	28	7
15434	196844	5365-01-132-1984	31	9
15434	199067	4730-00-404-2908	2	33
15434	199587	3040-01-079-1748	13	13
15434	199589	3010-01-079-1788	13	22
15434	200488		14	1
15434	200566	2815-01-077-4463	15	11
15434	200635	4730-01-078-6364	20	53
15434	200809	5330-00-026-2931	17	16
15434	200861	5310-00-134-4171	5	10
15434	200919	5340-00-132-3203	15	5
15434	202069	5305-01-086-7285	19	1
01276	2021-20-205	4730-00-202-8470	13	40
15434	202128		11	20
15434	202376	2950-00-432-1559	23	27
15434	202377	5330-00-406-7789	23	31
15434	202457	5330-00-026-2933	23	22
15434	202897	2910-00-951-3536	26	6
15434	202903	5315-01-058-4551	4	14
15434	202994	4720-01-070-8149	14	9
15434	203097	3120-01-083-6411	31	5
15434	203101	5330-01-080-2992	31	6
15434	203131	5310-00-426-3990	3	12
15434	203131	5310-00-426-3390	3	14
15434	203145	5330-01-066-3910	13	15
15434	203310		11	47
15434	203350	2910-01-080-5570	20	34
15434	203426	5306-01-079-6506	19	17
15434	203619	5305-01-072-8831	25	48
15434	203760	5310-01-112-4306	16	27
15434	204165	5305-00-795-9336	4	1
15434	204165	5305-00-795-9336	5	9
15434	204244	2815-01-086-1448	23	4
15434	204586	6620-01-047-2811	28	17
15434	204832	3020-01-085-3779	13	41
15434	206326		25	17
15434	208084		8	8
15434	208084		8	13
15434	208084		8	18
15434	208084		8	23
15434	208084		8	28
15434	208119	3040-01-079-3468	31	31
15434	208120	5365-01-080-0409	31	28
15434	208128	5330-01-040-2087	28	18
15434	208149	2930-01-065-7113	11	18
15434	208326	4730-00-477-4160	14	8
15434	208525	5310-01-079-6529	19	12
15434	208829	2930-01-098-0175	17	1
15434	209760	3120-01-080-3275	20	25

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15434	210179	5315-01-079-6740	4	10
15434	210647	5330-00-006-2494	22	17
15434	210707		11	21
15434	210713		16	10
15434	210884		2	30
15434	210915		11	19
15434	210916	4730-01-079-7459	28	4
15434	210966		11	13
15434	210967		11	37
15434	211027	4710-01-085-6130	11	31
15434	211222		14	24
15434	211375	2950-00-275-8276	23	17
15434	211435	6620-01-084-6011	28	15
15434	211636	3020-01-070-8528	25	29
15434	211918	3020-01-077-4411	4	4
15434	211939	5360-01-038-4659	13	5
15434	211999	5360-00-009-9270	3	7
15434	212161	5330-01-077-5228	11	30
15434	212601	2910-01-070-9004	25	34
15434	212602		25	36
15434	212603	5330-01-072-8828	25	8
15434	212604	5365-01-081-0662	25	19
15434	212605	2910-01-070-9003	25	20
15434	212607	6680-01-085-2871	25	4
15434	212609	3120-01-087-2539	25	5
15434	212610	3020-01-086-8780	25	7
15434	212613	3040-01-080-1529	25	12
15434	212639	3010-01-088-5727	25	21
15434	212668		25	35
15434	212754		16	11
15434	212954	5305-01-079-7028	19	25
15434	213082	5310-01-145-0762	31	24
15434	213394	5340-01-087-0682	3	29
15434	213395	5340-01-087-0681	3	30
15434	213456		16	26
15434	213485	4710-01-079-3198	28	10
15434	213559	2815-01-048-6702	9	8
15434	213740		2	2
15434	213768	5330-01-072-8983	20	69
15434	213769	3110-01-079-8190	20	67
15434	214086	2950-01-086-1447	23	34
15434	214139		20	31
15434	214144	2910-01-091-7507	20	63
15434	214146	2910-01-086-1651	20	21
15434	214150	5310-01-145-0761	20	11
15434	214154		14	20
15434	214306	2815-01-079-9146	16	24
15434	214345	4820-01-210-9571	29	7
15434	214577		2	11
15434	214617	5340-01-135-7250	28	12
15434	214730		6	9
15434	214836		14	30
15434	214950	3120-01-087-3004	6	6
15434	215039		14	18
15434	215041	4730-01-085-6132	14	7
15434	215042	2815-01-083-2123	29	8
15434	215044	5330-01-066-5357	14	19
15434	215045	5330-01-082-6984	14	38
15434	215090	5330-00-064-4399	2	3
15434	215195	4720-01-085-6293	23	11
15434	215233	3120-01-079-8194	7	7
15434	215397	3020-01-079-4206	31	32
15434	215587		14	39
15434	215705	5330-01-086-7257	16	13
15434	215787		26	4
15434	215965	3020-01-077-2229	4	11
15434	215966	3020-00-424-9995	7	11
15434	216020	2815-01-168-3742	6	17
15434	216128	4710-01-079-3493	21	12
15434	216165	2990-01-120-2883	7	3
15434	216467	2815-01-079-3317	29	16
15434	216486	5330-01-066-5352	14	22
15434	216487	5330-01-072-8998	14	4
15434	216524	5340-01-086-6193	3	24
15434	216802	2950-01-085-3580	23	16
15434	217034	2930-01-097-6755	17	5
15434	217315		11	14
15434	217323	6620-01-079-1632	4	3
15434	217372		14	29
15434	217632	4730-01-085-7328	15	3
15434	217736	2990-01-085-1622	23	15
15434	217795		20	24
15434	217798		20	29
15434	217932		14	37
15434	217933		14	35
15434	217934		14	41
15134	218152		8	11
15434	218153	3120-01-079-5208	8	12
15434	218245	5330-01-046-1991	11	25
15434	218274		31	15
15434	218732		6	10
75078	218736	4730-01-124-0293	8	32
15434	218808		6	4
15434	219107		9	13
15434	219138	5310-01-073-2854	23	5
15434	219153	5306-01-079-7027	6	5
93389	2304	5120-00-865-0933	33	25
24617	2436161	5310-01-102-3270	27	10
33457	255622	5330-01-084-9068	26	19
24617	272547	5306-00-418-2276	27	13
24161	28430	4720-00-541-4243	BULK	1
15434	2856		8	35
15434	3000082		16	25
15434	3000140	2815-01-083-3157	4	9
15434	3000164	2990-01-085-4768	23	21
15434	3000171	4310-01-092-9816	17	14
15434	3000173	5306-01-119-4271	17	21
15434	3000174	3040-01-085-2732	17	19
15434	3000446		20	52
15434	3000463		19	7
15434	3000464	2910-01-076-8632	19	23
15434	3000465	5310-01-079-6708	19	24
15434	3000521	5330-01-084-9067	8	33
15434	3000560		23	23
15434	3000888	4320-01-079-3454	31	18
15434	3000889	2930-01-079-2239	31	12
15434	3000907		11	9
15434	3000926	2815-01-079-3298	3	20
15434	3001296	2530-01-085-4153	25	32
15434	3001646		5	1

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15434	3001704	5365-01-079-7142	20	54
15434	3001704	5365-01-079-7142	25	51
15434	3001707	5365-01-079-8373	20	55
15434	3001847		20	28
15434	3002069		9	5
15434	3002110	2910-01-086-7715	25	3
15434	3002385	5330-01-066-5350	31	17
15434	3002731	2990-01-085-2607	23	18
15434	3003156	5330-01-072-8830	25	38
15434	3003480	7530-01-083-7892	1	5
15434	3003536	4730-01-079-3274	23	30
15434	3003682	2910-01-077-4976	19	2
15434	3003807	2950-01-071-5367	23	KIT
15434	3003814	2520-01-080-4473	11	6
15434	3004165		4	8
15434	3004188-3257	2910-01-065-3979	20	50
15434	3004261	5340-01-080-6654	29	11
15434	3004316	5330-00-005-0857	16	1
15434	3004724		25	6
15434	3005133	4310-01-092-9815	17	11
15434	3005507		31	4
15434	3005508		14	21
15434	3005919	3120-01-080-5482	9	7
15434	3005920	3120-01-079-5451	9	14
15434	3006175	5305-01-072-8826	20	70
15434	3006182	5305-01-118-8826	10	2
15434	3006183	2815-01-142-1732	10	5
15434	3006289	5307-00-922-2626	15	12
15434	3006343	2910-01-086-1449	20	75
15434	3006344		20	74
15434	3006349	2815-01-164-6103	10	4
15434	3006350		20	73
15434	3006351		20	73
15434	3006353		20	73
15434	3006358	2815-01-146-1024	10	6
15434	3006430		20	72
15434	3006456	2815-01-085-2618	3	25
15434	3006736	5330-01-145-7550	16	8
15434	3006738	5330-01-086-6112	7	4
15434	3006745		11	16
15434	3007070	3020-01-086-3417	31	3
15434	3007242	2815-00-230-0070	8	31
15434	3007513	5330-01-052-9988	31	21
15434	3007514		31	20
15434	3007713	5330-01-086-6197	11	17
15434	3007716		3	32
15434	3007759	5330-01-072-4436	3	27
15434	3008017	5330-01-079-6514	11	36
15434	3008060		13	38
15434	3008069		12	27
15434	3008089	2815-01-080-0642	3	23
15434	3008101	2815-01-085-8282	3	3
15434	3008172	2815-01-086-1422	6	11
15434	3008466		11	40
15434	3008469	4730-01-106-0202	5	17
15434	3008469	4730-01-106-0202	13	7
15434	3008472	2815-01-077-1482	6	14
15434	3008591	5330-01-086-3523	14	45
15434	3008596	4730-01-146-3111	12	10
15434	3008599		12	9
15434	3008690		11	7
15434	3008706	2910-01-077-2016	19	21
15434	3008947	5330-01-129-6541	17	32
15434	3008998	5330-01-049-0466	2	4
15434	3009185	2815-01-079-3321	1	4
15434	3009213		2	22
15434	3009468		19	8
15434	3009469		19	11
15434	3009470		19	6
15434	3009554		7	8
15434	3009566		19	9
15434	3009848	4710-01-106-8068	21	16
15434	3010030	5330-01-046-3144	11	34
15434	3010150	3110-00-144-8828	31	30
15434	3010242	5330-01-075-0948	26	KIT
15434	3010395		2	7
15434	3010590	5305-01-119-8621	17	22
15434	3010594	5305-01-130-6100	7	1
15434	3010595	5305-01-085-8197	11	12
15434	3010595	5305-01-085-8197	28	3
15434	3010595	5305-01-085-8197	29	14
15434	3010596	5305-01-088-6019	29	2
15434	3010597	5305-01-086-7036	11	26
15434	3010597	5305-01-086-7036	28	6
15434	3011233		11	2
15434	3011342		11	1
15434	3011711		16	4
15434	3011713		16	22
15434	3011931	5330-01-086-6203	29	13
15434	3011951	3120-01-079-6823	2	26
15434	3011952		2	27
15434	3012328	5315-01-086-6187	7	10
15434	3012332		6	8
15434	3012438	4730-01-085-9119	29	12
15434	3012468	5305-01-129-4386	31	35
15434	3012469	5305-01-147-4035	31	33
15434	3012476	5305-01-143-8112	29	20
15434	3012479		13	9
15434	3012483		5	8
15434	3012526	5310-01-126-1045	17	29
15434	3012538	2910-01-086-3974	19	15
15434	3013000	2930-01-087-8749	29	3
15434	3013336	3020-01-146-3773	17	31
15434	3013623		3	1
15434	3013630		2	15
15434	3013810	2910-01-142-7455	20	14
15434	3013811	2910-01-079-3320	20	16
15434	3013908	2815-01-105-8768	2	12
15434	3013930	2815-01-086-4508	6	1
15434	3014149	2815-01-086-2704	6	KIT
15434	3014397	4730-01-109-8501	21	19
15434	3014398	4730-01-146-3633	21	17
15434	3014404	2910-01-085-8096	2	9
15434	3014783	3020-01-084-9640	13	14
15434	3014784		13	29
15434	3014965	3020-01-104-2334	13	27
15434	3015373	4710-01-085-9348	21	22
15434	3015375	4710-01-085-9349	21	20
15434	3015393	4710-01-085-6134	21	18
15434	3015520		20	4

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15434	3015739	7690-01-094-6720	1	7
15434	3016456	4710-01-079-3487	23	29
15434	3016637	2815-01-160-5820	5	5
15434	3016887		9	23
15434	3017031		9	22
15434	3017032		9	17
15434	3017033		9	10
15434	3017040	2815-01-086-9757	9	11
15434	3017041	2815-01-086-3975	9	4
15434	3017042		9	3
15434	3017292	6680-01-108-7410	12	14
15434	3017750	5330-00-861-8592	8	38
15434	3017915		2	8
15434	3017996	2990-01-088-5922	25	23
15434	3018059	4720-01-085-2571	11	8
15434	3018346	2910-01-112-7712	19	3
15434	3018762	5330-01-092-4143	31	KIT
15434	3019158	5330-01-080-1773	28	5
15434	3019574	5305-01-145-0776	17	8
15434	3019962	5330-01-072-8829	25	33
15434	3020000	5330-01-066-5349	9	20
15434	3020002	5330-01-066-5348	9	19
15434	3020003	5330-01-066-5347	9	18
15434	3020753		21	24
15434	3020754		21	1
15434	3020943	5330-00-659-3178	15	1
15434	3021124	4820-01-158-0555	21	KIT
15434	3021462		20	17
15434	3021676	2910-01-086-1679	20	12
15434	3021705	5330-01-046-0441	16	2
15434	3021735	5330-01-082-6985	5	2
15434	3022377	4710-01-142-1667	12	29
15434	3022474	2930-01-072-8056	31	2
15434	3022968	2910-01-077-7303	19	5
15434	3023088	5310-01-142-2812	20	15
15434	3023171	2910-01-141-4029	20	9
15434	3023473	3020-01-146-3163	17	26
15434	3023870	5330-01-142-2784	20	10
15434	3024165	3040-00-449-7397	20	1
15434	3024709	5330-00-143-8369	29	1
15434	3024960	5330-01-146-7314	29	15
15434	3024960	5330-01-146-7314	31	10
15434	3026556	3120-01-147-5275	17	13
15434	3026557	5310-01-144-7368	17	17
15434	3030038	2815-01-122-4010	3	11
15434	3030970	2910-01-146-1048	24	5
15434	3031434	5330-00-033-9396	13	42
15434	3031469	5330-00-351-6428	12	8
15434	3032068	2990-01-085-2572	23	1
15434	3032348	5330-01-069-1472	14	27
15434	3032681	2815-01-146-1042	9	26
15434	3035053	5330-00-471-0370	25	37
15434	3036065	2815-00-300-0882	3	10
15434	3036126	5330-01-060-5021	3	33
94012	3038997	5330-00-011-7939	31	13
15434	3038998	5330-01-080-2992	31	26
15434	3044514	5330-01-066-3908	10	7
06991	321028-01	5930-01-127-2113	27	16
33457	3300922S	2940-01-065-7076	11	48
15434	3308958	5330-01-071-7687	11	49
15434	3375014	4910-01-097-6935	35	54
15434	3375015	5330-01-107-1841	35	55
15434	3375049	5120-01-160-8863	32	72
15434	3375086	4910-00-185-8508	34	84
15434	3375108	4810-01-097-6930	32	74
15434	3375108	4910-01-097-6930	34	53
15434	3375137	4910-01-097-6939	34	37
15434	3375140	4910-01-097-6940	34	34
15434	3375146	4910-01-097-6941	34	35
15434	3375147	4910-01-097-6942	34	36
15434	3375148	4910-01-097-6943	34	33
15434	3375150	4910-01-085-9211	32	1
15434	3375150	4910-01-085-9211	34	85
15434	3375153	4910-01-105-9165	35	26
15434	3375154	4910-01-097-6912	34	15
15434	3375159	5120-01-072-2952	32	56
15434	3375159	5120-01-072-2952	34	87
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15434	3375165	4910-01-097-6927	35	49
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15434	3375174	4910-01-097-6938	35	61
15434	3375180	4910-01-097-6989	32	48
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15434	3375205	4910-01-097-6985	34	60
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15434	3375221	4910-01-084-6977	35	38
15434	3375222	4910-01-084-6978	35	39
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15434	3375225	4910-01-084-7222	35	35
15434	3375226	4910-01-085-7269	35	34
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15434	3375425	4910-00-150-5858	32	14
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15434	3376177	5120-01-120-3681	35	40
15434	3376197		35	43
15434	3376619		34	83
15434	3376669	5120-00-104-1816	34	65
15434	3376684	5120-00-150-7488	34	39
15434	3376830		34	82
15434	3801047	2815-01-079-3380	7	9
15434	3801350	5330-01-086-7790	31	KIT
15434	3801595	2930-01-096-9035	31	1
15434	40662-A	5330-01-082-1906	7	5
15434	42645	2815-00-484-8359	2	24
15434	42646	3130-00-408-9041	2	31
15434	42647	2815-00-484-8360	2	21
15434	43463-A	5330-00-159-1464	28	11
15434	44678	2910-00-858-3522	25	46
15434	4797	3020-00-528-5053	5	13
79470	49X2	4730-00-278-3848	11	4
06991	501088-02		27	15
06991	501096-04	4720-01-146-4126	27	6
72582	5111798	4730-00-604-7953	14	28
19207	5329388	5315-00-532-9388	2	20
19207	5414243-20		21	3
53496	55611-2A	4730-00-555-8263	23	14
34623	5710454		30	3
34623	5730758	5340-01-145-1597	30	7
34623	5730761	4730-01-165-0749	30	8
34623	5730765		30	2
34623	5730768		30	10
34623	5730769		30	11
34623	5730770		30	9
34623	5730774		30	1
34623	5730775		30	5
34623	5739124	2930-01-184-1877	30	KIT
15434	60408	5315-00-238-0882	16	12
15434	60575	5365-00-428-6201	4	16
15434	61908	5365-00-282-5030	6	12
15434	61908	5365-00-282-5030	6	15
15434	63842	5310-00-134-4169	14	10
15434	64709		10	3
15434	64775	4720-00-361-2989	12	11
15434	64816A	5315-00-014-1244	22	5
15434	65259A	5365-00-361-2953	16	14
15434	65259B	5365-00-361-2953	16	14
15434	65259C	5365-00-507-3254	16	14
15434	65274	5330-00-246-0309	12	22
15434	65798	5340-00-417-5800	12	17
15434	66292	5310-00-197-5304	2	29
15434	6702	3030-01-065-9404	31	36
15434	67622	4730-01-128-4598	2	25
15434	67684	5310-00-262-2986	24	2
15434	67946	5365-00-197-9327	11	43
15434	67946	5365-00-197-9327	12	2
15434	68038	5340-01-066-2947	13	37
15434	68139	4730-01-142-8524	21	5
15434	68193	5340-00-404-2944	7	12
15434	68274	5360-00-664-5343	11	42
15434	68365	3120-00-566-0480	13	28
15434	68425	5340-00-839-0653	12	12
15434	68445	5315-00-281-7610	2	16
15434	68585	5315-00-014-1195	2	19
15434	68606	5365-00-716-6580	16	23
15434	68606	5365-00-716-6580	22	8
15434	69324		25	15
15434	69519	5315-00-475-2574	13	12
15434	69521	3120-00-627-6697	13	10
15434	69699	5310-00-962-5610	3	2
15434	69736	5305-00-339-1415	9	24
15434	69901	4730-00-924-7886	2	13
15434	69962	5365-00-695-1247	12	6
15434	70089-1	5330-00-537-2382	11	3
15434	70216		11	46
15434	70295	4730-00-011-3175	24	16
15434	70550		6	3
15434	70550	2815-01-124-0232	17	15
15434	70624	5330-00-506-4874	29	4
15434	70653	2815-00-772-9434	16	20
15434	70657	2815-01-122-8002	5	3
15434	70690	2990-00-772-1778	20	38
15434	70700	5360-00-597-4570	20	61
15434	70705	5330-00-562-1176	25	45
15434	70713	5340-00-898-1497	25	52
15434	70715	5310-00-507-3259	25	42
15434	70716	5305-00-506-5722	25	44
15434	70717	5365-00-507-3260	25	53
15434	70717A	5365-00-507-3261	25	53
15434	70717B	5365-00-462-4504	25	53
15434	70772	5305-00-477-6769	3	17
15434	70772	5305-00-477-6769	20	3
15434	70790	5306-00-485-0790	22	9
06991	8294151	2815-01-087-4740	27	KIT
06991	913020	5340-01-145-1181	27	7
06991	913024-06	2910-01-112-5797	27	2
06991	913032-04	2910-01-084-0243	27	12
15434	9226	5315-00-014-1284	5	19
24617	9418967		12	23
24617	9419002	5305-01-097-9886	27	3
24617	9422273	5310-01-099-0389	27	17
24617	9422277	5310-01-126-9404	12	15
15434	9427	5310-00-356-1447	2	14
15434	9674F		13	36

APPENDIX C

EXPENDABLE SUPPLIES AND MATERIALS LIST

Section I. INTRODUCTION

C-1. SCOPE.

This appendix lists expendable supplies and materials you will need to operate and maintain the Cummins NTC-400 Diesel Engine.

These items are authorized to you by CTA 50-970, Expendable Items (Except Medical, Class V, Repair Parts, and Heraldic Items).

C-2. EXPLANATION OF COLUMNS.

a. Column 1 – Item Number. This number is assigned to the entry in the listing and is referenced in the narrative instructions to identify the material (e.g., "Use dry cleaning solvent, item 5, App. D").

b. Column 2 – Level. This column identifies the lowest level of maintenance that requires the listed item.

C – Operator/Crew.

O – Organizational Maintenance.

F – Direct Support Maintenance.

H – General Support Maintenance.

c. Column 3 – National Stock Number. This is the National stock number assigned to the item; use it to request or requisition the item.

d. Column 4 – Description. Indicates the Federal item name and, if required, a description to identify the item. The last line for each item indicates the part number followed by the Federal Supply Code for Manufacturer (FSCM) in parentheses, if applicable.

e. Column 5 – Unit of Measure (U/M). Indicates the measure used in performing the actual maintenance function. This measure is expressed by a two-character alphabetical abbreviation (e.g., ea, in, pr). If the unit of measure differs from the unit of issue, requisition the lowest unit of issue that will satisfy your requirements.

Section II. EXPENDABLE SUPPLIES AND MATERIALS LIST

(1) ITEM NUMBER	(2) LEVEL	(3) NATIONAL STOCK NUMBER	(4) DESCRIPTION	(5) U/M
1	F		GREASE, AUTOMOTIVE AND ARTILLERY	
			GAA (MIL-G-10924C)	
		9150-00-065-0029	2-1/4-OZ TUBE	OZ
		9150-00-935-1017	14-OZ CARTRIDGE	OZ
		9150-00-190-0904	1-LB CAN	LB
		9150-00-190-0905	5-LB CAN	LB
		9150-00-190-0907	35-LB CAN	LB
2	F		OIL, LUBRICATING	
			OE/HDO 10 (MIL-L-2104C)	
		9150-00-265-9425	1-QT CAN	QT
		9150-00-265-9428	5-GAL DRUM	GAL
		9150-00-265-9429	55-GAL DRUM, 16 GAGE	GAL
		9150-00-265-9430	55-GAL DRUM, 18 GAGE	GAL
3	F		OIL, LUBRICATING	
			OE/HDO (MIL-L-2104C)	
		9150-00-265-9433	1-QT CAN	QT
		9150-00-265-9435	5-GAL DRUM	GAL
		9150-00-265-9436	55-GAL DRUM, 16 GAGE	GAL
		9150-00-265-9437	55-GAL DRUM, 18 GAGE	GAL
4	F		OIL, LUBRICATING, ICE, SUBZERO	
			OEA (MIL-L-46167)	
		9150-00-402-4478	1-QT CAN	QT
		9150-00-402-2372	5-GAL DRUM	GAL
		9150-00-491-7197	55-GAL DRUM	GAL

(1) ITEM NUMBER	(2) LEVEL	(3) NATIONAL STOCK NUMBER	(4) DESCRIPTION	(5) U/M
5	F		SOLVENT, DRY CLEANING, SD-II	
			(P-D-680)	
		6850-00-664-5685	1-QT CAN	QT
		6850-00-664-5685	1-GAL CAN	GAL
		6850-00-281-1986	55-GAL DRUM, 16 GAGE	GAL
		6850-00-285-8011	55-GAL DRUM, 18 GAGE	GAL
6	F		OIL, FUEL, DIESEL, DF-2, REGULAR	
			(VV-F-800)	
		9140-00-286-5294	BULK	GAL
		9140-00-286-5295	5-GAL CAN	GAL
		9140-00-286-5296	55-GAL DRUM, 16 GAGE	GAL
		9140-00-286-5297	55-GAL DRUM, 18 GAGE	GAL
7	F		OIL, FUEL, DIESEL, DF-1, WINTER	
			(VV-F-800)	
		9140-00-286-5286	BULK	GAL
		9140-00-286-5287	5-GAL CAN	GAL
		9140-00-286-5288	55-GAL DRUM, 16 GAGE	GAL
		9140-00-286-5289	55-GAL DRUM, 18 GAGE	GAL

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By order of the Secretary of the Army:

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IN THIS SPACE TELL WHAT IS WRONG AND WHAT SHOULD BE DONE ABOUT IT:

Paragraph 3-7c read dial gage for acceptable wear.
Figure 3-3 on next page shows the gage.
Change paragraph 3-7c to read "Read dial gage for acceptable wear (See fig. 3-2 and 3-3)"

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THE METRIC SYSTEM AND EQUIVALENTS

LINEAR MEASURE

1 Centimeter = 10 Millimeters = 0.01 Meters = 0.3937 Inches
1 Meter = 100 Centimeters = 1000 Millimeters = 39.37 Inches
1 Kilometer = 1000 Meters = 0.621 Miles

WEIGHTS

1 Gram = 0.001 Kilograms = 1000 Milligrams = 0.035 Ounces
1 Kilogram = 1000 Grams = 2.2 Lb
1 Metric Ton = 1000 Kilograms = 1 Megagram = 1.1 Short Tons

LIQUID MEASURE

1 Milliliter = 0.001 Liters = 0.0338 Fluid Ounces
1 Liter = 1000 Milliliters = 33.82 Fluid Ounces

SQUARE MEASURE

1 Sq Centimeter = 100 Sq Millimeters = 0.155 Sq Inches
1 Sq Meter = 10,000 Sq Centimeters = 10.76 Sq Feet
1 Sq Kilometer = 1,000,000 Sq Meters = 0.386 Sq Miles

CUBIC MEASURE

1 Cu Centimeter = 1000 Cu Millimeters = 0.06 Cu Inches
1 Cu Meter = 1,000,000 Cu Centimeters = 35.31 Cu Feet

TEMPERATURE

5/9 (^{0}F – 32) = ^{0}C
212^{0} Fahrenheit is equivalent to 100^{0} Celsius
90^{0} Fahrenheit is equivalent to 32.2^{0} Celsius
32^{0} Fahrenheit is equivalent to 0^{0} Celsius
9/5 C^{0} + 32 = F^{0}

APPROXIMATE CONVERSION FACTORS

TO CHANGE	TO	MULTIPLY BY
Inches	Centimeters	2.540
Feet	Meters	0.305
Yards	Meters	0.914
Miles	Kilometers	1.609
Square Inches	Square Centimeters	6.451
Square Feet	Square Meters	0.093
Square Yards	Square Meters	0.836
Square Miles	Square Kilometers	2.590
Acres	Square Hectometers	0.405
Cubic Feet	Cubic Meters	0.028
Cubic Yards	Cubic Meters	0.765
Fluid Ounces	Milliliters	29.573
Pints	Liters	0.473
Quarts	Liters	0.946
Gallons	Liters	3.785
Ounces	Grams	28.349
Pounds	Kilograms	0.454
Short Tons	Metric Tons	0.907
Pound-Feet	Newton-Meters	1.356
Pounds per Square Inch	Kilopascals	6.895
Miles per Gallon	Kilometers per Liter	0.425
Miles per Hour	Kilometers per Hour	1.609

TO CHANGE	TO	MULTIPLY BY
Centimeters	Inches	0.394
Meters	Feet	3.280
Meters	Yards	1.094
Kilometers	Miles	0.621
Square Centimeters	Square Inches	0.155
Square Meters	Square Feet	10.764
Square Meters	Square Yards	1.196
Square Kilometers	Square Miles	0.386
Square Hectometers	Acres	2.471
Cubic Meters	Cubic Feet	35.315
Cubic Meters	Cubic Yards	1.308
Milliliters	Fluid Ounces	0.034
Liters	Pints	2.113
Liters	Quarts	1.057
Liters	Gallons	0.264
Grams	Ounces	0.035
Kilograms	Pounds	2.205
Metric Tons	Short Tons	1.102
Newton-Meters	Pound-Feet	0.738
Kilopascals	Pounds per Square Inch	0.145
Kilometers per Liter	Miles per Gallon	2.354
Kilometers per Hour	**Miles per Hour**	0.621

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